جامعة القاهرة
معهد البحوث و الدراسات الأفريقية
قسم الموارد الطبيعية



ندوة الموارد الطبيعية و صونها في مصر و أفريقيا

19 – 21 مارس 2001

احتفالاً بمرور 30 عام على إنشاء القسم

و للاحتفاء بالعالم الجليل

أ.د / محمد عبد الفتاح القصاص

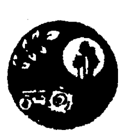
رائد علم البيئة العالمي و صاحب فكرة انشاء القسم

تحت رعاية

أ.د / نجيب الهلالي جوهر

رئيس جامعة القاهرة

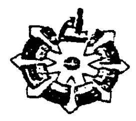
و الجهات الراعية



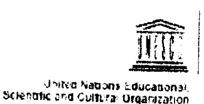
وزارة الزراعة
Ministry of Agriculture



جهاز شئون البيئة
Egyptian Environment Affairs Agency



أكاديمية البحث العلمي
Academy of Scientific Research & Technology



مكتب اليونسكو بالقاهرة

عميد المعهد

أ.د / السيد على أحمد فليفل

رئيس القسم

أ.د / فوزية إبراهيم مرسي

مقرر الندوة

أ.د / سمير إبراهيم غبور

بسم الله الرحمن الرحيم

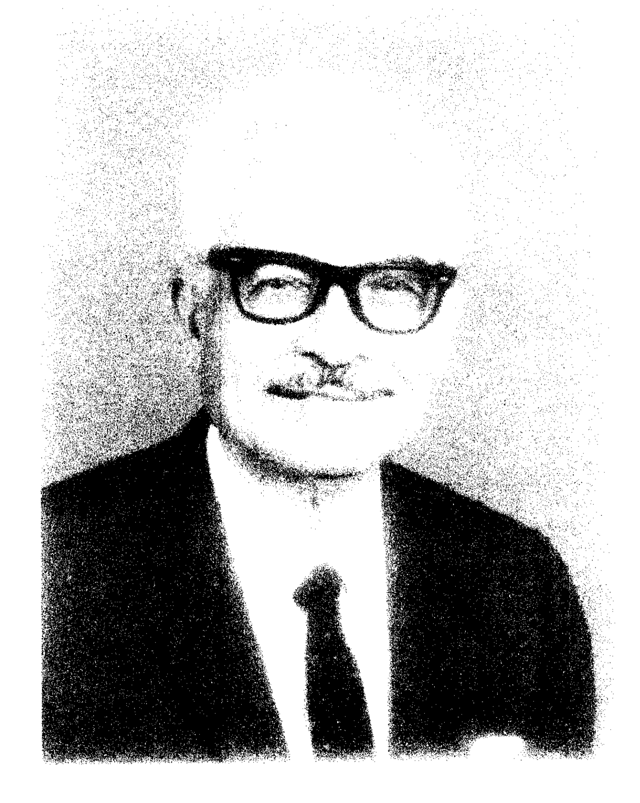
ندوة الموارد الطبيعية و صونها في مصر و أفريقيا

١٩ – ٢١ مارس ٢٠٠١

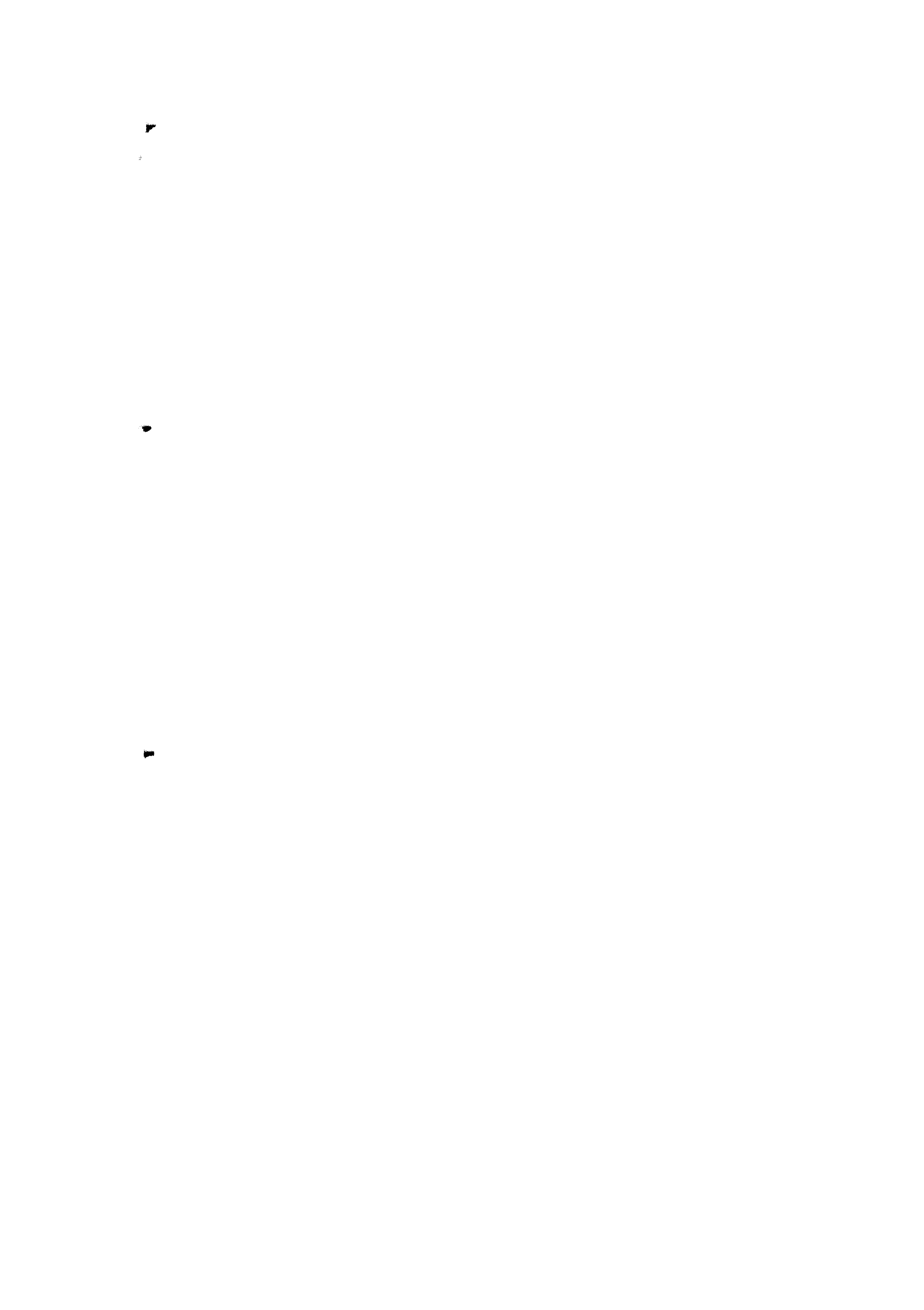
احتفالاً بمرور ٣٠ عام على إنشاء القسم

و للاحتفاء بالعالم الجليل

أ.د / محمد عبد الفتاح القصاص



العالم الجليل رائد علم البيئة العالمي و صاحب فكرة إنشاء القسم



جدول المحتويات (القسم العربي)

كلمة السيدة الاستاذة الدكتورة / فوزية ابراهيم مرسي

رئيس قسم الموارد الطبيعية

السيد الاستاذ الدكتور / نجيب الهلالي جوهر – رئيس جامعة القاهرة

السيد الاستاذ الدكتور / السيد أحمد فليفل – عميد معهد البحوث والدراسات الافريقية

السادة الضيوف والسادة الزملاء

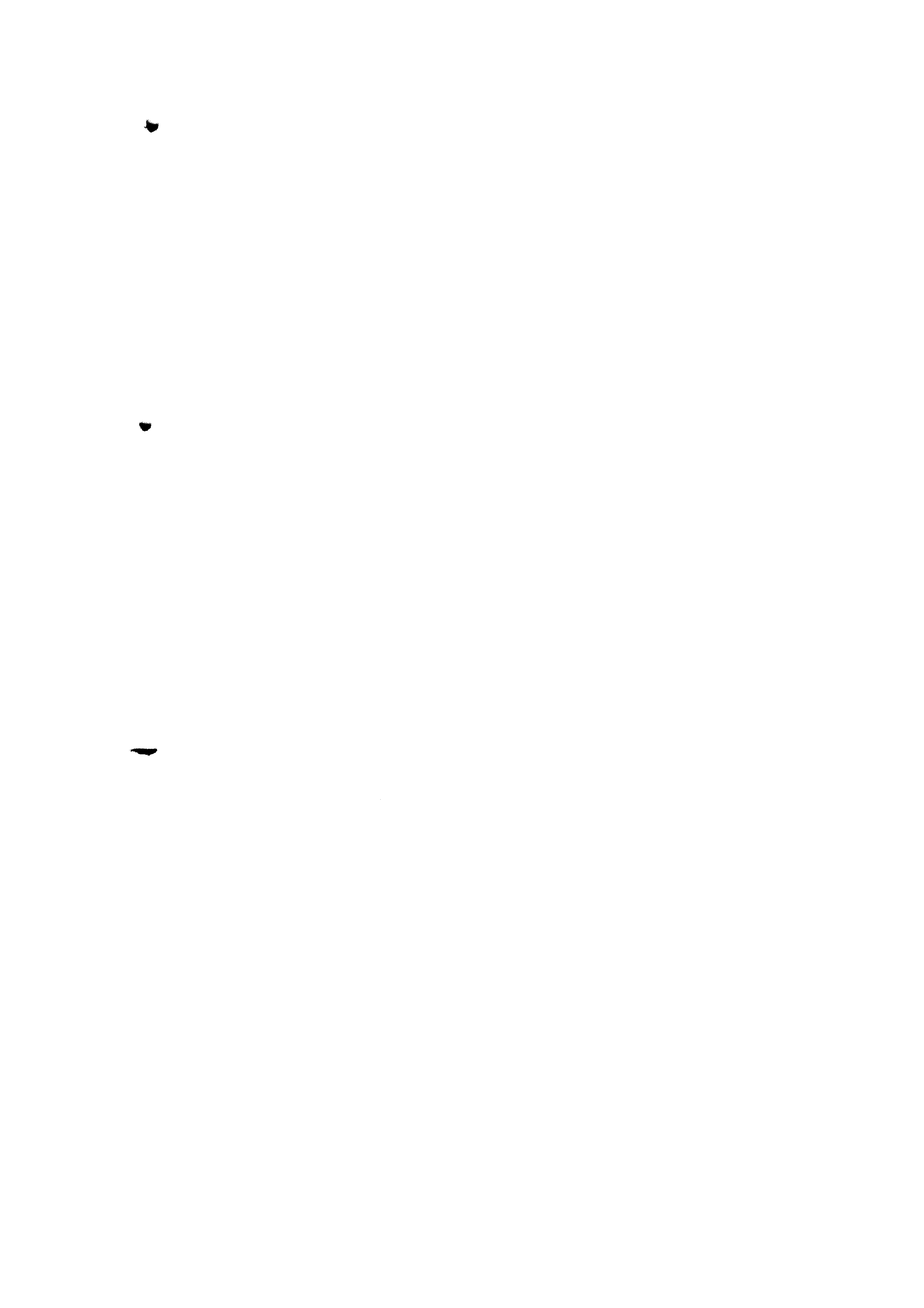
يشرفني ويسعدني أن أشارك في أفتتاح ندوة قسم الموارد الطبيعية كما يسعدني تشريف الاستاذ الدكتور محمد عبد الفتاح القصاص العالم الجليل الذي كان له الفضل في إنشاء قسم الموارد الطبيعية أحد أقسام المعهد السته و يضم قسم الموارد الطبيعية الموارد التالية (الأرضية – المائية – النباتية – الحيوانية – الجوية) ، كما يضم عدد من الاساتذة شغل منهم وكيلين للدراسات العليا و وكيلين لشئون البيئة وخدمة المجتمع .

يهتم القسم بتدريس الموارد الطبيعية بقارة افريقيا مثل الجيولوجيا – المناخ – الحيوان – التربة – النبات– الماء بقصد أكتشاف الموارد الطبيعية في الدول الافريقية وحل مشاكلها ولا تزال القارة في حاجة لمسح شامل كما أن حيالها النباتية والحيوانية لم تسجل حتي الان، لذلك نتمني المزيد من الدراسات حتي تساهم مصر في كشفها العلمي كما ساهمت في كشفها الجغرافي.

التحق بالقسم ٨٨٤ طالب وطالبة علي مدي ٣٠ عاما ، حصل ٢٤ طالب وطالبة علي درجة الدكتوراه من القسم ،٨٢ طالب وطالبة علي درجة الماجستير في التخصصات المختلفة.

يسعدنا اليوم أن نكرم بكل فخر وأحترام أ.د. محمد عبد الفتاح القصاص متمنين لسيادته موفور الصحة وعدد من الأساتذة الذين شاركوا و ساهموا في التدريس علي مدي ٣٠ عام.

وأخيرا كل الشكر والتقدير والتهنئة لعميد المعهد أسرة قسم الموارد الطبيعية ، داعين الله أن يحقق للقسم والمعهد أهدافهم العلمية و الوطنية و القومية. وتمنياتي لكم بدوام التوفيق في أعمالكم المستقبلية .



كلمة السيد الأستاذ الدكتور / سمير غبور

مقرر الندوة

كان من دواعى فخرنا فوز الأستاذ الدكتور/ محمد عبد الفتاح القصاص موخرا بجائزة الشيخ زايد الدولية للبيئة ، وهى أول مرة تمنح فيها هذه الجائزة القيمة ، ولذا نشرف بأن تقدم له التهنئة على هذا الفوز العظيم .

وقد ولدا أستاذنا فى ٦ يوليو ١٩٢١ بإحدى قرى شمال الدلتا ، وهى قرية بــرج الــبرلس الساحلية ، بمحافظة كفر الشيخ ونال تعليمه الثانوى بالإسكندرية ثم حصل على درجة البكــالوريوس فى العلوم (تخصص علم النبات) من كلية العلوم بجامعة القاهرة عام ١٩٤٤ . و أوفدته الدولة فى بعثــة حيث حصل على درجة الدكتوراه من جامعة كمبريدج بالمملكة المتحدة عام ١٩٥٠ فى علــم البيئــة النباتية . وعاد إلى مصر ليلتحق بهيئة التدريس بكلية العلوم بجامعة القاهرة ، حيث هو الآن أستاذ غــير متفرغ .

وعند عودته إلى مصر بدأ الأستاذ الدكتور/القصاص بدراسة البيئة النباتيــة فى الصــحارى المصرية وانتهج نهجا جديدا إذ عكف على دراسة آليات تكون أنماط توزيع النباتــات فى الصــحراء وليس الاكتفاء بمجرد وصف هذه الأنماط . وشاركه فى هذه الدراسات أستاذنا الدكتور/ مصطفى إمام . وفى أواخر الخمسينات اشترك مع ثلاث علماء آخرين من أوربا فى تنفيذ مشــروع مشــترك بــين اليونسكو والفاو لوضع خريطة بيومناخية وأخرى للغطاء النباتى فى منطقة حوض البحر المتوسط ومــا حوله من بلدان . ولتنفيذ ذلك جاب سيادته الصحارى المصرية مع لفيف مــن تلاميــذه النجبــاء ، وشاركة فى هذه الدراسة أوخونا الأستاذ الدكتور/ محمد عبد القوى زهــران والمرحومــان الأســتاذ الدكتور / سامى الأبيض والأستاذ الدكتور/ وليم عبد الله جرجس . وقد مكنــت هــذه الدراســات الميدانية أستاذنا الدكتور/ القصاص من أن يتفهم بالكثير من الوضوح آليات حياة النبات فى الصحراء والعوامل البيئية التى تؤثر عليها .

وقد عمل أستاذنا الدكتور/ القصاص بجامعة الخرطوم بالسودان فترتين كانــت أولاهمــا فى الفترة من عام ١٩٥٢ حتى عام ١٩٥٦ والأخرى من عام ١٩٦٤ حتى ١٩٦٨ . وقــد شــاهد فى الفترة الولى ظاهرة التصحر وتمكن من قياس معدلاتها ، أما فى الفترة الأخرى فقد استطاع أن يتأكــد من دقة ملاحظاته وأن يتحقق من أن قياساته فعلا مخيفة . وفيما بين الفترتين استطاع أن يقيس أيضــا النحر لشاطئ الدلتا عند قريته الساحلية قبل وبعد إتمام بناء السد العالى عند أسوان . وعنــدما تقــدم سيادته بنتائج هذه البحوث فى المحافل العلمية الجادة فى أواخر الستينات ، بهتت العشيرة العلمية العالمية من دقة قياساته ومن رصانة استنتاجاته وتحذيراته .

كان هذا هو الوقت الذى أخذت تتبلور فيه الحركة البيئية العالمية وتتشكل فيه اجهزتها . وقد دعاه رجل الأعمال الإيطالى الشهير أوريليو بيتشى للانضمام إلى ما أسماه "نادى روما" وهــو مجموعــة من مائة من كبار الخبراء العلميين العالميين للتباحث فى أمور العالم وتوعية الشعوب و القادة بالمخــاطر

البيئية المحتملة ، ونشر الكتب التى تضم ما ينتهون إليه من تحذيرات . وكان أول هذه الكتب والذى أثار ضجة شديدة فى العالم هو كتاب "حدود النمو" عام ١٩٧٢ . وصار أستاذنا بهذا فى موقع يتيح له أن يعطى نصائحه القيمة لمشروعات هذا المنتدى البحثية و لمطبوعاته . ثم انتخب استاذنا نائبا لرئيس اللجنة العلمية للمسائل البيئية (سكوب) التى أنشاها المجلس الدولى للاتحادات العلمية بباريس . زطلب استاذنا حينئذ من اللجنة الاهتمام بالمسائل البيئية للدول النامية ، حيث أن المفهوم السائد وقتئذ كان أن المشاكل البيئية ليست سوى المشاكل التلوث فى الدول الصناعية . وقد استجابت اللجنة لطلبه هذا وعقدت الاجتماع الدولى الأول للعلوم البيئية فى الدول النامية بمدينة كانبرا بأستراليا عام ١٩٧١ والثانى فى نيروبى بكينيا عام ١٩٧٤ والثالث بالقاهرة عام ١٩٨٣ . وكان استاذنا هو الذى يضع المحاور ويختار المدعوين ويشرف على نشر النتائج . وفى عام ١٩٧١ عاون فى إنشاء برنامج الأنسان والمحيط الحيوى باليونسكو وكان نائبا لرئيس أول مجلس تنسيقى له .

وفى عام ١٩٧٢ ، حينما عقد مؤتمر الأمم المتحدة للبيئة الإنسانية فى ستوكهولم بالسويد ، قام أستاذنا بجهد كبير لأعداد التقرير الوطنى المصرى وشارك كعضو فى الوفد المصرى الذى رأسه أستاذنا الدكتور/ مصطفى طلبة ، صديق عمره . وقد صار الأستاذ الدكتور/ مصطفى طلبة فيما بعد المدير التنفيذى لبرنامج الأمم المتحدة للبيئة الذى انبثق عن المؤتمر . وشارك أستاذنا الدكتور/ القصاص ايضا وفى ذات المؤتمر كعضو فى وفد المنظمة العربية للتربية والثقافة والعلوم (إليكسو) . وهى التى كان قد شارك فى إنشائها قبل ذلك بعامين . وعمل أستاذنا مديرا مساعدا للعلوم فى هذه المنظمة فى الفترة من ١٩٧٨ وأنشأ خلال هذه الفترة عدة برامج بيئية للعمل العربى المشترك منها : برنامج حماية بيئة البحر الأحمر وخليج عدن ، وبرنامج التربية البيئية على مختلف المستويات ، ومشروع الحزام الأخضر لشمال أفريقيا ، الخ. وعمل بعد ذلك كبيرا لمستشارى برنامج الأمم المتحدة للبيئة .

وفى عام ١٩٧٨ انتخب استاذنا بالإجماع رئيسا للاتحاد الدولى لصون الطبيعة والموارد الطبيعية بسويسرا وظل فى منصبة هذا حتى عام ١٩٨٤ . ومن خلال هذا المنصب تعاون مع الاستاذ الدكتور/ مصطفى طلبه (برنامج الأمم المتحدة للبيئة) والأمير فيليب زوج ملكة المملكة المتحدة و الذى كان رئيسا للصندوق العالمى للحياة البرية ، فى إصدار الاستراتيجة العالمية لصون الطبيعة . وهى الوثيقة التى حوت لأول مرة تعبير " التنمية المتواصلة " هذا التعبير الذى تقدمت به اللجنة الدولية للتنمية والبيئة التى شكلتها الأمم المتحدة عام ١٩٨٣ لدراسة العلاقة بين هذين الأمرين من أمور العالم الملحة . وتبنت الجمعية العامة للأمم المتحدة مفهوم التنمية المتواصلة الذى تقدمت به إليها تلك اللجنة عام ١٩٨٧ وأوصت أن تهتدى جميع جهود التنمية فى العالم بمبادئة .

وبالإضافة إلى كل تلك الأعمال الجليلة ، اشترك أستاذنا مع علماء آخرين من الولايات المتحدة وروسيا فى الإعداد لمؤتمر الأمم المتحدة للتصحر الذى عقد فى نيروبى عام ١٩٧٧ وفى إعداد خطة العمل العالمية لمكافحة التصحر ، والتى أسفرت فى النهاية عن توقيع الاتفاقية الدولية لمكافحة التصحر عام ١٩٩٤ . وعمل أستاذنا أيضا على إنشاء مركز البيئة والتنمية لأوربا والإقليم العربى

(سيدارى) الموجود بالقاهرة حاليا لذا يمكن القول باختصار إن أستاذنا شارك فى كـــل برنـــامج دولى للبيئة وفى كل منظمة دولية للبيئة ظهرت الى الموجود فى العقود الثلاث الأخيرة .

أما على الصعيد الوطنى ، فلا بد أن نذكر اولا إنشاءه مدرسة علمية من مجموعة متميزة مـــن التلاميذ والمريدين فى مجال علم البئة النباتية وعلوم البيئة . وعمل على انشاء اللجان الوطنية المصـــرية لبرنامج الماب واللجنة سكوب ولاتحاد صون الطبيعة ، ورأس سيادته هذه اللجان من عام ١٩٧١ حتى عام ١٩٨١ . وساعد ايضا على انشاء جهاز شئون البيئة عام ١٩٨٣ . كما أنشـــأ وحـــدة التنـــوع البيولوجى به عام ١٩٩٢ . وفى اوائل التسعينات أشرف على اعداد خطة العمل البيئى لمصـــر ، وفى اواخرها أعد خطة مصر الوطنية للتنوع البيولوجى . وكان الناصح الأمين والموجه الحكيم لكل خطوة اتخذها جهاز شئون البيئة منذ إنشائة . ويمكن القول إن القوانين والإجراءات البيئية التى تصـــدر عـــن جهاز شئون البيئة هى من وحى توجيهاته . واختير سيادته عضوا بمجلس الشورى عام ١٩٨١ .

واخيرا وليس آخرا ، كان لأستاذنا الفضل فى الاقتراح المقدم بمبادرة منه الى جامعة القـــاهرة لإنشاء قسم للموارد الطبيعية ضمن معهد البحوث والدراسات الأفريقية ، عند النظر فى تطوير هـــذا المعهد عام ١٩٧٠ ، وهو الأمر الذى تم تنفيذة عام ١٩٧١ . ولهذا نحتفل ضـــمن فعاليـــات نـــدوة " الموارد الطبيعية وصونها فى مصر وأفريقيا " الذى يعقد فى الفترة مـــن ١٩ الى ٢١ مـــارس ٢٠٠١ ، بمرور ٣٠ عاما على انشاء القسم ، وايضا ببلوغ حبيبنا العام الثمانين من عمرة المديد بإذن الله سبحانه وتعالى ، إنه سميع مجيب الدعاء .

بقيت كلمة حق يجب أن تقال عن كريم خصال أستاذنا وعن الخبرة التى يتلقاها كـــل مـــن يجلس إليه . فأستاذنا رجل لا طموحات مادية له ، ولا رغبات عالمية لديه ، ولا احقاد أى كان .

إن طموحاته تنحصر فى وطنه فقط ، وللبشرية جمعاء ، أن رغباته هى معاونه مـــن حولـــة ، ورعايتهم ، " وفتح أبواب يكبر الناس منها" ، كما يحلو له أن يقول ، ونسأل الله سبحانه وتعـــالى أن يمنحة الصحة والعافية وحياة مديدة سعيدة الى جوار احبائه وعارفى فضله .

سمير ابراهيم غبور
استاذ متفرغ بقسم الموارد الطبيعية ، معهد البحوث والدراسات الأفريقية
جامعة القاهرة



كلمة السيد الأستاذ الدكتور / أحمد أمين حمزة

رئيس جامعة المنصورة

استاذى الفاضل الاستاذ الدكتور/ محمد عبد الفتاح القصاص

الاستاذ غير المتفرغ بكلية العلوم جامعة القاهرة — وخبير البيئة العالمى

السيد الاستاذ الدكتور/ السيد على احمد فليفل

عميد معهد البحوث والدراسات الافريقية

السيد الاستاذ الدكتور/ سمير ابراهيم غبور .... مقرر الندوة

زملائى .. وزميلاتى ..

السادة الحضور..

السلام عليكم ورحمة الله وبركاته

بكل التقدير يشرفنى أن أشارك حضراتكم فى هذا المحفل العلمى الكريم ، ألا وهو الندوة القومية عن "صون الموارد الطبيعية فى مصر وأفريقيا" ، والتى تناقش موضوعات بيئية على جانب كبير من الأهمية ، وتأتى فى إطار أنشطة معهدكم الموقر والتى تتزامن مع مرور ثلاثين عاما على إنشاء قسم الموارد الطبيعية بمعهد البحوث والدراسات الأفريقية ، وتتزامن أيضا مع مناسبة غالية على نفوسنا جميعا ألا وهى بلوغ أسستاذنا الجليل أستاذ الدكتور/ محمد عبد الفتاح القصاص وأستاذ أجيال عديدة من الاساتذة والباحثين الثمانين من عمره المديد ، والحق أن هذا يوقظ فى نفسى العديد من الأفكار والمعانى من الأهمية بمكان التوقف أمامها تجلية وتحلية .. ففى الربع الأول من القرن العشرين وتحديدا فى عام ١٩٢١ كانت مصر والإنسانية جميعا على موعد مع مقدم عبقرية من وأدى النيل ، كان قدرها أن توقظ شعلة البحث العلمى ، وتضيف الى التراث الإنسانى والعلمى أبعادا جديدة فى مجال الدراسات والبحوث البيئية .. كانت هذه العبقرية هى العالم الكبير الاستاذ الدكتور/ محمد عبد الفتاح القصاص الأستاذ الجامعى المرموق ، والذى شارك من خلال فكرة وموقعه فى إثراء البحث العلمى والتقدم التكنولوجى فى مصر ، وأول من نبه الى أهمية العد البيئى وتأثيرة على مستقبل التنمية ، وأيضا أهمية الربط بين العلوم الأساسية والتطبيقية ، وان الجامعة فى جوهرها مؤسسة لصناعة العلم ، وان الأستاذية مصدر للقيم والعطاء .. وعلى الجانب الشخصى ومن خلال التعامل والتفاعل مع هذه القمة المصرية الشامخة يتألق العديد من القيم الأخلاقية والإنسانية والعلمية ، لعل فى مقدمتها إيمانه بأهمية المنهج والتخطيط العلمى ، وحبة وعشقة لمصر ، فنيل مصر يجرى فى عروقة ، وصحارى ووديان مصر ماثلة فى فكرة ووجدانه ، وروح القرية تمثل علامة مميزة فى شخصيته ، موسوعة علمية متنقلة ، بحر من العلم الغزير ، أمواجه هادرة وعطاؤه متجدد موصول .. ولعل هذه الجوانب فيض من غيض ، وهى ما افتعلت فى نفسى .. ولكن من الإنصاف أن نشير الى العديد من السمات الأخرى لعل فى مقدمتها التواضع الجم ، والأدب الرفيع ، وطيب المعشر ، وسعة الأفق .

مسابقة منظمة الوحدة الأفريقية والمنظمة العالمية للملكية الفكرية (الوايبو WIPO لاختيار احسن مخترع افريقى فى مجال الصحة والطاقة وتكنولوجيا الغذاء والتعاون مع المنظمة الأفريقية الاقليمية للملكية الصناعية (اريبو ARIPO

مع المؤسسات التنظيمية :

الاكاديمية الأفريقية للعلوم – المجلس العلمى لافريقيا

اتحاد المشتغلين بالعلم والتكنولوجيا لكل أفريقيا

تدريب الكوادر :

براءات الاختراع – تدريب العاملين بمكاتب الملكية الصناعية فى الدول العربية والافريقية الدورات التدريبية لراصدى الزلازل الافارقة والعرب (عدة دورات بمعارفة صندوق التعاون المصرى الافريقى بوزارة الخارجية)

نقل الخبرات :

أوغندا : خبرة ج.م.ع فى التخلص من الحشائش المائية

الحبشة : خبرة الاكاديمية فى تخطيط العلم والبحث العلمى وادارته

حضور المؤتمرات المختلفة :

لم تتوان ج.م.ع عن المشاركة فى اية مؤتمرات ذات العلاقة سواء فى الداخل او الخارج .

كلمة السيد الاستاذ الدكتور/ محمد يسري موسي

رئيس اكاديمية البحث العلمى والتكنولوجيا

إسهامات البحث العلمى المصرى فى النهوض بالقارة الأفريقية

يشمل الحديث من تلك الاسهامات النقاط التالية :

مقدمة : عن دور مصر عامة فى تحرير معظم دول القارة الأفريقية وانشاء منظمة الوحدة الأفريقية ثم تقسيمات مجموعات دولها جغرافيا فى المنظمات الدولية الاقليمية المختلفة .

وتمتد مجالات التعاون لتشمل المجالات الاتية

العلم والتكنولوجيا بعامته

المؤتمر الثانى للعلم والتكنولوجيا للقارة الأفريقية (كاست أفريقيا) مع منظمة اليونسكو الذى عقد فى اروشا (تنزانيا) خلال الفترة من ٢-١٥ يوليو ١٩٨٧.

- اجتماعات الخبراء الحكومين للعلم والتكنولوجيا وقد عقدت دورات تمهيدا لعقد المؤتمر الاقليمى للعلوم والتكنولوجيا فى أفريقيا باديس ابابا (الحبشة) خلال ٦-١٠ نوفمبر ١٩٩٥.

- البيئة :

شاركت الاكاديمية فى اجتماع مجموعتها الاقليمية (تحت SHASREG فى باماكو (مالى) خلال الفترة من ١٣-١٦ ديسمبر ١٩٨٣ وكذلك فى الاجتماع النهائى للمجموعات الاقليمية السبع خلال الفترة من ١٠-١٣ ابريل ١٤٨٩ بمدينة لوزاكا (زامبيا) تمهيدا للاعداد والاشتراك فى المؤتمر الاول لوزراء البيئة الافارقة فى القاهرة خلال الفترة ١٦-١٨ديسمبر ١٩٨٥ . عضوية مجموعة العمل لاعداد الاطار التنفيذى لبرنامج استعادة النظام البينى للمناطق الأفريقية التى تأثرت بالجفاف وعملية التصحر فى نايفاشا (اعمال نيروبى فى كينيا) خلال الفترة ٢٤-٣١ سبتمبر ١٩٨٥.

علوم البحار:

اتفاقيتا حماية حوض البحر الابيض المتوسط وكذلك التنمية البيئية لحوض البحر الاحمر وخليج عدن .

- مؤتمر المصايد الداخلية فى أفريقيا CIFA

- المشاركة فى مؤتمر تنمية الثروة السمكية فى البحر الاحمر وخليج عدن

- المعلوماتية :

الارتباط بنظام باديس PADIS النظام المعلوماتى لكل أفريقيا

- براءات الاختراع :

أما قسم الموارد الطبيعية فقد استقطب إليه أساتذة من طراز أ.د. محمد عبد الفتاح القصاص وأ.د. مصطفي كمال طلبه وأ.د. عبد الهادي راضي وأ.د.محمود أبو زيد ، وعشرات غيرهم قاموا بتأسيس ووضع الخطط والبرامج المطلوبة لبدا العمل ، ثم قاموا بالتدريس والإشراف العلمي علي عشرات الرسائل للماجستير والدكتوراه ، وقدموا لكافة المؤسسات المتخصصة في مصر قيادات تتولى مسئولية العمل العلمي والتنفيذي بنجاح مشهود .

إن قسم الموارد الطبيعية يوشك إنتاجه العلمي أن يقترب من أرقام الإنجاز العلمي للقسمي القديمي المؤسسي التاريخ والجغرافيا ، ولقد قدم القسم إلي المعهد إضافة حاسمة علي صعيد التنمية في أفريقيا في مجالات حيوية مثل الطب والزراعة والبيئة النباتية الحيوانية .

وكان القسم طرفاً فعالاً في برامج البيئة المصرية تعليماً وترسيخاً لقيم جديدة ، وذلك بحكم ارتباط أساتذة القسم بأعلام البيئة في مصر ، وخاصة الرائد المؤسس أ.د. عبد الفتاح القصاص ، ولقد نشأ جيلي في المعهد يتابع بالإعزاز كله رموزاً شامخة تؤدى دورها في دقة متناهية ، وبتواضع جم في نفس الوقت ، ممزوج بقدر غريب من الروح الأبوية الراعية .

لقد راعى هولاء الأساتذة العظماء أجيالا متتابعة من الباحثين ، صاروا نجوماً في الأوساط الأكاديمية والمواقع التنفيذية ، ومن ثم فإن معهد البحوث والدراسات الأفريقية لا يحتفي بأشخاصهم فقط إنما يحتفي بقيمهم ومبادئهم التي أرسوها في نفوسنا .

وإذ نرجو دائما أن تزداد صلتنا بأساتذتنا الأفاضل اللذين أضافوا إلي رسالة المعهد ، كما نرجو أيضاً أن نشير إلي الأساتذة الأجلاء من أعضاء هيئة التدريس بالقسم ، الذين حملوا عبء العمل اليومي ، وتحركوا من أجل استكمال الهياكل العلمية ، وتوفير المقومات المادية ، وذلك لبدء العمل والاستمرار . ومازلت أذكر جولات أستاذنا الجليل المرحوم أ.د. مصطفي أمام رئيس القسم الأول بمعيدي القسم في سنيه الأولي يمر بهم علي كليات الجامعة ومعاملها ، وعلي مركز البحوث الزراعية ، والمركز القومي للبحوث ، ومركز البحوث المائية ، ليبحث لهم عن مشرف هنا ومعمل هناك ومواد كيميائية هنالك ، ثم لا يكتفي بذلك ، إنما يحميهم من عناء المواصلات العامة ، ويرد كلا منهم إلي منزله بعد عناء يوم طويل . وعلي يديه.

وبرفق الأستاذ الدكتور / القصاص امتلأ القسم بالباحثين ، وعرفنا جهودا مكملة قام بها زملاؤه أ.د. سمير غبور – أ.د. محمد طارق لبيب – أ.د. عادل الحسنين – أ.د. وفائي عازر – أ.د. فوزية مرسي . وبقية أعضاء هيئة التدريس المخلصين من أجل نجاح مسيرة القسم .

وقد شاءت الأقدار في الآونة الأخيرة أن تتجدد الدماء بالقسم بتبادل العمل في المعهد مع مطلع القرن الجديد بدءا من العميد والوكيلين ورؤساء الأقسام ، وأصبح معيدو مرحلة التطوير من ثلاثين عاما مسئولين عن العمل الأكاديمي في المعهد ، ثم أنصاف جيل جديد من المعيدين نعول عليهم كثيرا في صياغة مستقبل جديد للقسم والمعهد .

وقد نجحت هذه القيادات بفضل ما درجت عليه من دقة في التخطيط وقدرة علي المتابعة تعلمتها من الأساتذة الرواد في أن تصوغ معهم للمعهد خطة خمسية للسنوات الخمس القادمة ، وتضع

لائحة جديدة مطابقة لنظام الساعات المعتمدة وكلية الدراسات العليا تتضمن عددا من الدبلومات التطبيقية ، تستهدف ربط الجامعة بالمجتمع وتلبية احتياجاته ، وتدريب المعنيين بالشئون الأفريقية ، وتوفير الثقافة الأفريقية خارج نطاق درجات الدبلوم والماجستير والدكتوراه .

ولقد كان لقسم الموارد نصيب كبير في كافة برامج التطوير بحكم طبيعته العلمية ، وإيلائه أهمية خاصة لأوضاع التربة والنبات والحيوان ، فضلاً عن اهتمامه بالبيئة بالمفهوم الشامل مياها ومناخا ، جفافا وتصحرا ، معالجة لشح الموارد حينا وإرشادا له لتجنب تدميرها حينا أخر .

وعلي الرغم من كل ذلك فإنني أرجو أن يرعى الزملاء الأعزاء بقسم الموارد وهم يحتفلون بثلاثين عاما علي تأسيسه ضرورة التوسع في جانبين من البحوث والدراسات ، أري لهما أهمية خاصة في حياة مصر والأفارقة علي السواء ، هما الموارد المائية والإنتاج الحيواني ، وهما لازمان لمصر ، وتقتضي المصلحة الوطنية أن تتبلور فيهما دراسات وبحوث ذات طبيعة عملية ، وأن يؤسس القسم في مجالهما كوادر علمية جديدة .

وقد تكون تلك رسالة مستقبلية أثق أن زملائي الأعزاء في قسم الموارد سوف يقدرونها حق تقديرها ، يضطلعون بها بكل الجد والإحساس الوطني المعروفين عنهم .

واحب في ختام كلمتي أن أتوجه بخالص الشكر للأستاذ الدكتور / سمير غبور مقرر الندوة و أ.د. فوزية إبراهيم مرسي رئيس قسم الموارد ، وجميع الإخوة الأفاضل أعضاء هيئة التدريس ومعاونيهم بالقسم ، فضلاً عن إدارة المعهد والعاملين لما بذلوا من جهد شاق من أجل اجتماع شملنا هذا .

كما أشكر الأساتذة الأفاضل والباحثين الأعزاء الذين شرفوا الندوة بالحضور والمشاركة في تكريم أستاذنا الجليل محمد عبد الفتاح القصاص ، وكل الأعلام المكرمين .

كما أوجه تحية خاصة لكل الجهات التي دعمت الندوة وعلي رأسها وزارة الزراعة ، وجهاز شئون البيئة ، وأكاديمية البحث العلمي والتكنولوجيا ، ومكتب اليونسكو بالقاهرة ، كما أحب أن أعبر عن امتناني وشكرى الجزيل للدعم الذي تلقته أسرة المعهد من إدارة الجامعة بقيادة السيد الأستاذ الدكتور / نجيب الهلالي رئيس الجامعة ، فلا شئ يمكن أن يوفيه حق من الشكر والتقدير ، ولا أملك من كلمات تكفيه هذا الحق إلا أن أدعو له بطول العمر والصحة وبدوام التوفيق .

كما أحب أن أشكر أ.د. مفيد شهاب وزير التعليم العالي والدولة للبحث العلمي أن تكرم بوضع الندوه تحت رعايته مع أ.د. نجيب الهلالي جوهر رئيس الجامعة .



كلمة السيد الأستاذ الدكتور / السيد فليفل

عميد المعهد

بسم الله الرحمن الرحيم

ربنا افتح بيننا وبين قومنا بالحق وأنت خير الفاتحين

أ.د. نجيب الهلالي جوهر	رئيس جامعة القاهرة
أ.د. محمد عبد الفتاح القصاص	رائد علم البيئة العالمى
أ.د. أحمد حمزة	رئيس جامعة المنصورة
أ.د. محمد يسري موسي	رئيس أكاديمية البحث العلمي والتكنولوجيا
أ.د. إبراهيم عبد الجليل	رئيس جهاز شئون البيئة
أ.د. محمد قنديل	مدير مكتب اليونسكو
أ.د. ممدوح رياض	ممثل الدكتور يوسف والي نائب رئيس الوزراء
أ.د. سمير غبور	مقرر الندوة
أ.د. فوزية إبراهيم مرسي	أمين عام الندوة و رئيس قسم الموارد الطبيعية

أساتذتي الإجلاء زملائي وزميلاتي الضيوف الكرام

يسعدني أن أرحب بكم في رحاب معهد البحوث والدراسات الأفريقية في هذا اليوم التاريخي الذي نحتفل فيه بنجاح المسيرة العلمية لأحد أقسام المعهد عبر ثلاثين سنه من العطاء وذلك منذ تأسيسه ضمن الأقسام الجديدة قسم النظم السياسية والاقتصادية وقسم اللغات وقسم الأنثروبولوجيا ألا وهو قسم الموارد الطبيعية .

لقد أضافت هذه الأقسام قدراً هائلاً من الحيوية إلي قسمي المعهد الأولين : قسم التاريخ وقسم الجغرافيا ، اللذين تحملاً مسئولية التأسيس . وفيما يتعلق في هذه الأقسام الجديدة فأنها نجحت أن تستقطب إلي معهدنا أعداداً كبيرة من رموز العمل الأكاديمي في جامعة القاهرة والجامعات المصرية الأخرى .

فقد أستقطب قسم النظم السياسية شخصيات مثل أ.د.بطرس غالي وأ.د.عبد الملك عوده و إبراهيم صقر رحمه الله ، فضلاً عن عشرات من السفراء المؤهلين للدكتوراه ذوى الخبره الميدانية في الشئون الدولية .

وقد استقطب قسم اللغات كلا من أ.د. عبد الحميد الدواخلي رحمه الله ، و أ.د. حسين نصار وأ.د. محمود فهمي حجازي وغيرهم من علماء اللغة .

كما أستقطب قسم الأنثروبولوجيا أساتذة مؤسسين للعلم ، منهم الأستاذ العظيم الدكتور / أحمد أبو زيد وأ.د. محمد محمود الجوهري ، وأ.د. عبد الهادي الجوهري رحمه الله.

زملائى .. وزميلاتى ..

لم تكن مصر عبر تاريخها الطويل منغلقة على ذاتها ، بل يمكن القول أنها كانت حلقة اتصال بين الحضارات ، ولعل موقعها الجغرافى الممتاز وريادتها للعالم العربى والأفريقى ، وما تتطلبة هذه الريادة من فهم ودراسة افضل لواقع القارة الأفريقية ، كانت الباعث لإنشاء معهد البحوث والدراسات الأفريقية ، ونظرا لما احتلته قضايا الموارد الطبيعية وقضايا البيئة من مكانه مرموقة فى العصر الحديث كان إنشاء قسم الموارد الطبيعية ، بمبادرة كريمة من الاستاذ الدكتور/ محمد عبد الفتاح القصاص ، فى رؤية ثاقبة لأغوار المستقبل وتحدياته .. من هنا ، ولذلك ، فالحبل موصول ، والعرى وثيقة بين العالم الكبير وبين هذه المؤسسة العلمية وبين أعمال ندوتنا هذه .

زملائى .. وزميلاتى :

الحديث ذو شجون ، والافكار والمشاعر تتعانق معا ، ويجتمع وسام العلم مع وسام الخلق فى مدار واحد .. فكل التقدير والتهنئة لأستاذى الجليل الأستاذ الدكتور/ محمد عبد الفتاح القصاص داعيا الله أن يمد فى عمره ، ويمتعه بالصحة والعافية ، وكل التقدير والتهنئة لآخى وزميلى الأستاذ الدكتور/ السيد على احمد فليفل عميد معهد البحوث والدراسات الأفريقية ، وكل التقدير والمودة الى آخى وزميلى الأستاذ الدكتور/ سمير ابراهيم غبور مقرر الندوة والى جميع اسرة قسم الموارد الطبيعية وأسرة المعهد الموقر .. متمنيا أن تحقق هذه الندوة أهدافها القومية والوطنية .

والله من وراء القصد

والسلام عليكم ورحمة الله وبركاته..

كلمة السيد الأستاذ الدكتور / *نجيب الهلالى جوهر*

رئيس جامعة القاهرة

السيد الاستاذ الدكتور/ محمد يسرى ، رئيس اكاديمية البحث العلمى والتكنولوجيا

السيد الاستاذ الدكتور/ احمد حمزة رئيس جامعة المنصورة

السيد الاستاذ الدكتور/ ابراهيم عبد الجليل رئيس جهاز شئون البيئة

السيد الاستاذ الدكتور/ السيد فليفل ، عميد معهد البحوث والدراسات الأفريقية

السيدة الدكتورة / فوزية مرسى ، رئيس قسم الموارد الطبيعية

السيد الاستاذ الدكتور/ سمير غبور ، مقرر الندوة

تحية طيبة وبعد ،،،

يطيب لى أن اتقدم الى حضراتكم اليوم بأجمل التهانى على قيامكم بهذه الندوة التى تحتفلون فيها بمرور ثلاثين عاما على انشاء قسم الموارد الطبيعية بمعهدكم الموقر وكذلك للاحتفاء بعيد الميلاد الثمانين لاستاذنا الجليل الاستاذ الدكتور محمد عبد الفتاح القصاص، اطال الله فى عمره ومتعه بالصحة والعافية .

والحق أن قسم الموارد الطبيعية يمثل فكرة رائدة كان لأستاذنا المحتفى بـه الفضل الاول فى التفكير به و المبادرة باقتراح انشائه كأحد اقسام معهدكم الموقر وهو الأمر الذى تم بحمد الله وبفضل منه فى مثل هذا الوقت منذ ثلاثين عاما . وقد تم هذا فى وقت كانت تتبدى فيه معالم التلوث البيئى الذى اخذ يفزع الدول الصناعية ، ومظاهر تدهور الموارد ، وخاصة التصحر وتدهور الاراضى ، فى الدول النامية ، وقد كانت بعض الصعوبة فى تقبل فكرة انشاء اقسام للعلوم البيئية على المستوى الاكاديمى ، ولكن اليوم تتضح اهمية مثل هذه الاقسام التى صارت نمطا شائعا على مستوى الجامعات المصرية والاجنبية ، وقد تم انشاء اقسام بينية اخرى فى رحاب جامعة القاهرة منذ ذلك الحين ، ولعلى اذكر منها المعهد القومى لعلوم الليزر.

ويسرنى أن قسم الموارد الطبيعية تمكن من القيام بالمهام الملقاة على عاتقة كما نتمنى ، وان الكثيرين من ابناء مصر النجباء قد درسوا به وحصلوا منه على ارفع الشهادات ، وانه يضم خيرة الباحثين والعلماء القائمين على تقدم مختلف التخصصات التى يضمها . واننا نتوقع من القسم المزيد من التقدم والسير الى الامام ، حتى يحقق ما نصبو اليه جميعا من رفعة وسداد .واسمحوا لى ، حضرات السيدات والسادة ، أن اذكر عن استاذنا المحتفى به البعض من خصاله الحميدة التى عرفتها عنه ، فهو مبكر الحضور ونجده دوما فى مكتبة ، يحاور تلامذته من طلبة ومن اساتذة ، ويداوم على حضور اللجان التى تنشئها الجامعة للتباحث فى امورها ، ويدلى فيها دوما بارائة السديدة ولا يبخل علينا ابدا بوقته الثمين لمشورة او المجاملة وهو الاستاذ الاب والمرشد ونرجو له كل صحة وعافية .

وفى الختام اود أن اشكركم مرة اخرى على دعوتكم الكريمة ونرجو أن تثمر مداولاتكم فى ندوتكم هذه عن بحوث وتوجهات قيمة تنفع الوطن وتنفع الناس



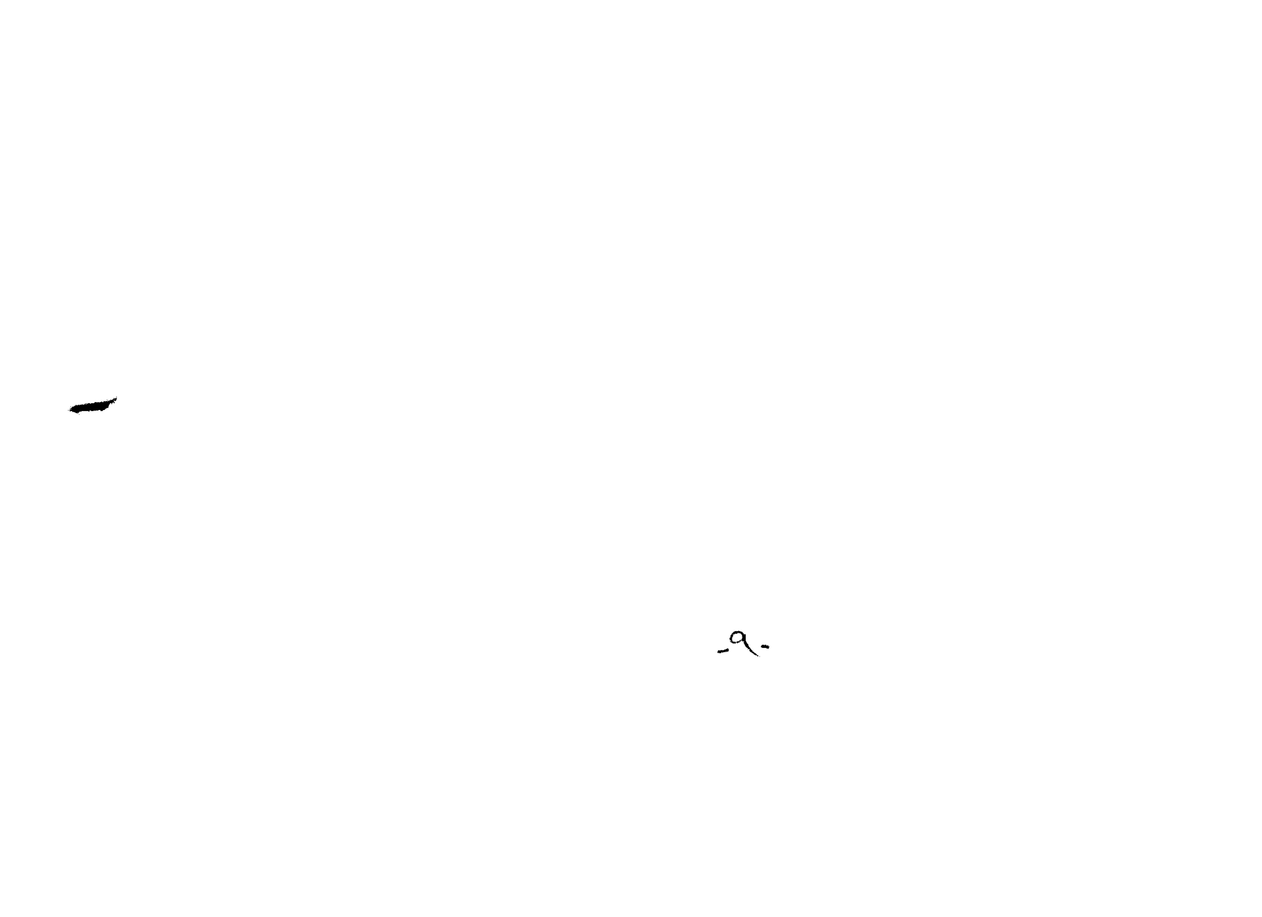
أسماء العلماء المكرمون في العيد الثلاثين لقسم الموارد الطبيعية

بمعهد البحوث والدراسات الأفريقية – جامعة القاهرة

تقديرا لخدماتهم للقسم

(بالترتيب الأبجدي)

١ – أ.د.أبو الفتوح عبد اللطيف
٢ –أ.د. أحمد جمال عبد السميع
٣ – أ.د.أحمد عبد الخالق
٤ – أ.د.أحمد فخرى
٥ – أ.د.أحمد لطفى كابش
٦ – أ.د.أحمد محمد مجاهد
٧ –أ.د. أحمد نبيل شاهين
٨ – أ.د.أحمد هرجه
٩ – أ.د.جمال مهران
١٠ – أ.د.جورج فليب عازر
١١ – أ.د.حسن الشربيني
١٢ – أ.د.حسن عامر
١٣ –أ.د. الرفاعي بيومي
١٤ –أ.د. ربيع فولي
١٥ – أ.د.سمير إبراهيم غبور
١٦ – أ.د.ضياء القوصى
١٧ – أ.د.عادل سعد الحسنين
١٨ – أ.د.عبد الحميد عطا
١٩ –أ.د. عبد الرحمن أنيس
٢٠ – أ.د.عبد الهادى راضي
٢١ –أ.د. عائشة العيوطى
٢٢ – أ.د.كامل حنا سليمان
٢٣ – أ.د.كمال الدين البتانوني
٢٤ – أ.د.كمال حفنى
٢٥ – أ.د.محمد أحمد الشهوى
٢٦ – أ.د.محمد رفعت شلش
٢٧ – أ.د.محمد سعد الدين حرب
٢٨ – أ.د.محمد طارق لبيب
٢٩ – أ.د.مصطفى أمام محمود
٣٠ – أ.د.مصطفى العيوطى
٣١ – أ.د.نجيب نصار
٣٢ – أ.د.فوزية إبراهيم مرسي
٣٣ – أ.د.وفائى زكى عازر



دور المركز القومي لبحوث المياه في ادارة وتنمية الموارد المائية في مصر

أ.د. محمد رفيق عبد لباري

نائب رئيس المركز القومي لبحوث المياه

١ – نبذة عن نشاط المركز واهدافه :

- أنشئ مركز البحوث المائة بقرار رئيس الجمهورية رقم ٨٣٠ لسنة ١٩٧٥ ويتبع وزير الري ويشكل من احدى عشر معهدا بحثيا وفي عام ١٩٤٤ صدر القرار الجمهوري رقم ٣١٦ في شان اعادة تنظيم المركز القومي لبحوث المياه وتم زيادة المعاهد الى ١٢ معهد بحثيا باضافة معهد بحوث التغيرات المناخية والبيئية .
- ويهدف المركز القومي لبحث المياء الى اجراء البحوث والدراسات في مال توفي وتنمية المياه اللازمة للوفاء باحتياجات البلاد ، والمحافظة عليها من لتدهور والتلوث ، وحل المشكلات العلمية والتطبيقية المتعلقة بالسياسات العامة لاتخدامات المياه ، وادارة الموارد المائية ومشروعات الرى والصرف ورفع كفاءلها ، وكذلك الدراسات المتعلقة بنهر النيل والد العالي وللمركز أن يقوم بكل من شأنه أن يدرأ عن البلاد كل ماتتعرض لـه مـن اخطار ، ويتولى المركز اجراء الدراسات الخاصة بتخطيط وتطوير وتنظيم ومراقبة مصادر المياه الوفية في مصر بالتعاون مع الجهات البحثية الأخرى .
- وللمركز في سبيل تحقيق ذلك القيام باجراء الدراسات والبحوث والأنشطة العملية في المجالات الآتية.
  - طرق الاستخدام الأمثل للموارد المائية بكافة مصادرها السطحية والجوفية وتقدير كمياقما واقتراح السياسات والاستراتيجيات المائية.
  - تدبير الموارد المائية اللازمة لمواجهة الاحتياجات الراعية وغيرها من الاحتياجات المائية
  - كافة الأمور المتعلقة بتعظيم استخدام المياه وفقا للمعايير المقررة بمافي ذلك تكرار استخدامها .
  - المحافظة على نوعية المايه ويانتها وحمياقما من التلوث .
  - افضل اساليب التصميم والتشييد والصيانة لنشات الري والصرف وطرقها ومعداقما .
  - حماية شواطئ البحار والبواغير وتنميةالشريط الساحلي والحفاظ على البحيرات الشمالية
  - تصميم وصيانة الترع والمصارف ومقاومة الحشائش .
  - التشريعات التنظيمية للحفاظ على الموارد المائية وتنميتها .
  - متابعة التقدم لعلمي والتطور التنظيمي والعمل على نقل مايخدم تنمية الموارد المائية .
  - اعداد وتنمية الكوادرالعلمية والفنية في التخصصات اللازمة لنشاط المركز ومعاهده .
  - تقديم المشورة الفنية والاقتصادية لمشروعات المياه في الداخل والخراج من خلال اجهزته ومعاهده البحثية .

- التعريف باوجه نشاط المركز عن طريق النشر وغير ذلك من وسائل الاعـــلام العلمـــي والعمل على تجميع وتوثيق المعلومات والبيانات الخاصة بالموارد المائيـــة ونظـــم الـــري والصرف وما يتعلق بها من مشروعات ودراسات واستخدامات .

ويتكون المركز من المعاهد البحثية الآتية:

- معهد بحوث ادارة المياه وطرق الرى .
- معهد بحوث الصرف .
- معهد بحوث الموارد المائية .
- معهد بحوث نهر النيل
- معهد بحوث الهيدروليكا
- معهد بحوث صيانة القنوات المائية
- معهد بحوث المياه الجوفية .
- معهد بحوث الانشاءات
- معهد بحوث الميكانيكا والكهرباء .
- معهد بحوث المساحة .
- معهد بحوث الشواطئ.
- معهد بحوث التغيرات المناخية وأثارها البيئية على الموارد المائية.

٢- أهم الانجازات والاسهامات :

قام المركز بالاسهام بالبحوث والدراسات في المشروعات القومية وهـــي مشـــروع توشـــكى — مشروع ترعة السلام — مشروع تنمية شمال غرب خليج السويس وهذا بالاضافة الى الدراســـات التي قام بها وتقع تحت واجباته ومسئولياته .

هذه الاسهامات تتلخص في الاتي :

أولاً : مشروع توشكى :

- اختيار موقع محطة الرفع .
- تصميم قناة المص ومواسير الطرد .
- دراسة تأثير الطمي على مأخذ محطة الرفع .
- حصر تصنيفي للتربة بمنطقة توشكى.
- استخدام صور الأقمار الصناية في عمل خرائط طبوغرافيـــة لمســـاحة ١٠٠,٠٠٠ فدان .
- تقييم احواض المياه الجوفية وتحديد مواقع الآبار .

ثانياً :ترعة السلام

- تحديد المصارف المستخدمة لامداد الترعة بالمياه .
- تحديد نسب الخلط من نهر النيل .
- عمل الحمايةالكاثودية لسحارات جادوس والسرو وبحر البقر وبالوظة .
- حماية وتدعيم جسور الترعة .

ثالثاً : مشروع تنمية شمال غرب خليج السويس .

- تصميم وسائل الحماية من أخطار السيول .

رابعاً : دراسات عامة .

- إعداد وتحديث الخرائط الهيدروجيولوجية لمصر وعددها ٤٠ خريطة .
- اطلس المياه الجوفية بهدف حماية الخان الجوفي من التدهور الكمي والنوعي .
- شبكات رصد نوعيات المياه في نهر النيل والمصارف والمياه الجوفية وجاري تنفيذ شبكات قومية .
- دراسة ووضع سياسات تنمية وحماية المياه اجلوفية بمدينة العاشر من رمضان ومدينة السادات .
- تصميموانشاء ورصد مواق الشبكة الاساسية لخليج السويس .
- انشاء ورصد قيم الجاذبية لشبكة القومية الاساسية للجاذبية الارضية بمصر وانتاج الخرائط اللازمة .
- المشروع الاقليمي لادارةالمياه تحت ظروف الرى التكيلي على مستوى الحقل للوصول الىأعلى عائد .
- حصر وتصنيف الحشاش المائية بمحر نهر النيل .
- دراسات حماياةالشاطئ الشمالي .
- تطبيقات طاقة الرياح والطاقة الشمسية في رفع المياه .
- دراسة التاثر الديناميكي للزلازل على المنشآت الهندسية .
- تطبيقات النماذج الرياضية ونظم دعم واتخاذ القرار على نظم الادارة المتكاملة للمياه وعرلاقة ذلك بادارة مايه الصرف، مع عمل نظم ادارة المعلومات الجغرافية لمياه الصرف.
- عمل جميع الدراسات الخاصة بالصرف المغطى اللازمة للمشروع القومي للصرف المغطى
- الدراسات الهيدورليكية الخاصة لقناطر نجع حمادى وكذلك الدراسات البيئية .
- دراسات البيارات خلف المنشآت المائية
- حصر اولويات المصادر المائية غير التقليدية .
- انشاء نموذج لدعم اتخاذ القرار للتنمية المستدامة لمصر في القرن الواحد والعشون وذلك من خلال اطار حسابي معتمد على بيئة برمجية ذت توجيه شئ كما يتح هذا نموذج مع نموذج خبير لرسم السياسات والبدائل المقترحة في السياسات المائية المختلفة .
- الآثار الاقتصادية والبيئية لاستخدام المياه المعاد استخدامها .
- ابتكار طريقة جديدة لحماية جسور النيل ثم استخدامها لتصميم وتنفيذ ٢٠٠كم من جسور النهر .
- اعداد خطوط ادارة النهر في الحبس من أسيوط وحتى قناطر الدلتا ومن نجع حمادى وحتى أسيوط .
- دراسة عن مصادر واحتياجات البلاد من المياه حتى ٢٠٢٠م.

- دراسة عن أثر السدة الشتوية على انتاجية المحاصيل المختلفة وكذلك على نقل وتوزيع المياه ومنشآت التحكم .
- اعداد دراسة جدوى اقتصادية لتنمية منطقة شرق البحيرات لمساحة ٤٠ ألف فدان.
- اعداد دراسة لتصميم وتحديد مسار ترعة الصرف الجديدة واعمال التحكم الهيدروليكية اللازمة لها ووضع التراكيب المحصولية ونظم الرى التي تلائم نوعية المياه بالمنطقة .
- تطوير وتحسين ادارةالرى الحقلي في مناطق المنصورية وكفر الشيخ والمنيا.
- دراسة تكنولوجيا معالجة مياه الصرف من خلال وحدات تعمل بالطاقة الشمسية .
- إعداد الخريطة الهيدرولوجي المجمعة لشبه جزيرة سيناء .
- اعداد الدليل الهيدروليكي لوديان محافظات أسيوط ـــ سوهاج ـــ قنا ـــ أسوان .

٣- أهم الأعمال الجارية :

فيما يلي أبرز الأعمال الجارية للمركز

- مراقبة ومتابعة كميات ونوعية مياه الصرف الزراعي لكل من الدلتا والفيوم واضافة مواقع متابعة نوعية مياه الرى بالترع الرئيسية بالدلتا .
- المساهمة في وضع معايير اختيار مناطق تجديد واحلال شبكات الصرف المغطى مع تقييم اداء معدلات تنفيذ الشبكات وصيانتها .
- دراسات الترسيب في بحيرة ناصر .
- دراسة تقليل الفواقد بالبخر .
- رصد نوعية المياه بنهر النيل .
- الاشراف على اعمال تطوير فرع دمياط ملاحيا.
- الدراسات الهيدروليكية الخاصة بزيادة استيعاب قناة مفيض توشكى لتأمين سلامة السد العالي .
- دراسة الآثار البيئية الناجمة عن التوسع الزراعي حول بحيرة ناصر .
- دراسة استقطاب مياه الضباب بالمناطق الساحلية والجبلية الواقعة بجنوب سيناء .
- دراسة نوعية المياه ببحيرة المنزلة وآثارها على الثروة السمكية .
- البدء في تجهيز نموذج مناخي اقليمي لمنطقة البحر المتوسط .
- دراسة احصائية للتغيرات المناخية في مصر خلال القرن الماضي وتاثيرها على الوضع البيئي .
- استخدام وتطوير النماذج المناخية للتنبؤ بالأمطار على الهضبة الأثيوبية.
- انشاء نموذج لدعم اتخاذ القرار لتخطيط الموارد المالية واستخداماتها على أساس الاتزان البيئي .
- غسيل التربة بسهل الطينة.
- تحديد الاحتياجات المائية لمختلف المحاصيل الزراعية في مناطق الجمهورية المختلفة تحت ظروف المياه السطحية والجوفية ونوعيتها .
- دراسة تطبيق نظم الرى الحديثة في الأراضي القديمة والدلتا .

- دراسة تنمية وتطوير بحيرة قارون .
- دراسة الشحن الصناعي للآبار الجوفية في منطقة توشكى .
- وضع المخطط التفصيلي لتنمية المياه بالوادي الجديد .
- دراسات تنمية الموارد المائية وحل مشكلة المياه الجدوفية بواحة سيوه .
- الادارة الكهرويكانيكية للمياه.
- دراسات تكامل الطاقة .
- متابعةتطور خط الشاطئ للساحل الشمالي عن طريق برصج الآعماق للقطاعات البحرية الموزعة على طول الساحل من الاسكندرية وحتى بورسعيد .
- تسجيل التغيرات الحادثة في منسوب سطح البحر .
- دراسة خصائص المياه الشاطئية ومصادر التلوث بها .
- استخدام تكنولوجيا الاستشعار عن بعد في انتــاج الخــرائط الطبوغرافيــة للمنـــاقط الصحراوية.
- دراسة تحركات القشضرة الارضية في المناطق الغير مستقرة في مصر .
- دراسة تأثير الحشائش المائية العائمة على الكفاءة الهيدلوليكية للمجارى المائية .
- دراسة مشكلة انتشار الحشائش المائية والطحالب ببحيرة ناصر.
- صيانة القنوات المائية والاسلوب الأمثل لاعادة ارنكة القطاعات المائية المستبحرة.
- تقييم مصارد المياه السطحية من خلال اجراء الدراسات الهيدرولوجية ودراسات بــدائل استغلالها والحماية من أخطار السيول .
- تقييم وتنمية واستغلال الخزانات الجوفية (السطحية والعميقة) والعيــون مــن خــلال الدراسات الهيدرولوكيمائية ودراسات المشروعات المناسبة .

٤- الخطة المستقبلية للمركز القومي لبحوث المياه

تحددت أهداف الخطة المستقبلية للمركز القومي لبحوث المياه في الآتي :

أولاً : مجال حماية وتنمية الموارد المائية السطحية التقليدية وغير التقليدية .

– رفع كفاءة ادارة مياه النيل وبحيرة ناصر عن طريق :

- المحافظة على اتزان النهر وحماية جوانبه لوقف فقدان الاراضي الزراعيــة والمنشآت الحيوية على جوانب النهر .
- تحسين نوعية المياه في نهر النيل وبحيرة ناصر وذلك من بالحد من التلــوث من المصادر المختلفة .
- رصد الترسيب في بحيرة ناصر وتأثير ذلك على سعة الخزان .
- حماية المنشآت الرئيسية المقامة عليه لضمان كفاءها في حجز وتوزيع المايــه وادارها .
- رفع كفاءة حصار الامطار والسيول في الساحل الشمالي شبه جزيرة سيناء .

- اعداد اطلس لمياه السيول مع تحديد الحدود الآمنة لمجاري السيول الرئيسية.
- رصد وتحليل البيانات الخاصة بحصر وتصنيف الحشائش المائية وآثارها على شبكة الري والصرف ونهر النيل وبحيرة ناصر.
- دراسة امكانية تعديل المناخ بمنطقة الساحل الشمالي من خلال زراعات معينة.
- تجميع الضباب كمصدر مياه بالمناطق الجبلية والساحلية.
- استخدام الحشائش المائية في تنفيذ المياه العادمة.
- توفير مصادر أخرى للمياه عن طريق استخدام مياه الصرف الزراعي المخلوطة بالمياه العذبة ومياه الصرف الصحي المعالجة .

ثانياً : مجال حماية وتنمية الموارد المائية الجوفية

- تنمية خزان الحجر الرملى النوبي .
- تنميةالمياه الجوفية بجنوب مصر وواحة سيوه والبحر الأحمر بالصحراء الشرقية .
- حماية خزانات المياه الجوفية من التلوث .
- الاستخدام المشترك للمياه الجوفية والسطحية .
- استخدام مياه الصرف الصناعي للشحن الاصطناعي للخزانات الجوفية .
- حماية الآثار المصرية من أخطار المياه الجوفية .
- تحديث الخرائط الهيدروجرافية بمقاييس رسم مختلفة.

ثالثاً : مجال ري وصرف الأراضي الزراعية :

- رفع كفاءة الرى الحقلي للمحاصيل المختلفة عن طريق :

- تقدير وحساب الاستهلاك المائي .
- تطوير شبكة الري وادخال طرق ري عالية الكفاءة .
- تقوية روابط المزراعين لتولى مسئولية توزيع المايه على مستوى الترع الفرعية والمساقى
- تقدير الفواقد المائية على مستوى ترع التوزيع والترع الفرعية وملاسقى وجراسات تقليلها .
- تحسين نوعية مياه الري والصرف .
- تأهيل شباب الخريجين على ادارة وصيانة نظم الرى والأعمال الزراعية المختلفة .
- تطوير وتحسين صرف الأراضي الزراعية .
- رصد وإدارة مياه الصرف الزراعي كما ونوعا.
- رفع كفاءة اداء وتشغيل شبكتي الرى والصرف عن طريق صيانة الترع والمصارف وتحديد العوامل التي تساعد على اتزانها ومقاومة الحشائش فيها .

رابعاً: مجال حماية الشواطئ من التآكل والتلوث :

- متابعة وتدعيم ورصد المشاكل التي تتعرض لها الشواطئ والبواغيز والمنشـــآت البحريـــة وتحديد العوامل المؤثرة عليها لايجاد أنسب الحلول لها .
- التخطيط العام لمشروعات حماية وتنمية الشواطئ ودراسة التأثير البيئي لها .
- رصد التغيرات الشاطئية الحالية والمستقبلية .

خامساً : مجال استخدام الطاقة التقليدية وغير التقليدية في الموارد المائية .

- زيادة كفاءة وأداء محطات الطلمبات من خلال زيادة العمر التشغيلي وتقليل الفاقــد في الطاقة والحفاظ على معدلات التشغيل .
- إنشاء خرطية متكاملة وقاعدة بيانات للطاقة والمياه باستخدام النظم الآلية.
- دراسة توفير الطاقة المستخدمة في ري الأراضي الزراعية من أسوان حتى قنا عن طريق شق ترعة تأخذ من بحيرة ناصر بدلا من محطات الرفع .

سادساً : مجال منشآت الرى والصرف:

- حماية المنشآت الرئيسية على النيل سواء من ناحيـــة التـــأثير الهيـــدروليكي أو الآحمـــال الديناميكية .
- صاينة وتدعيم المنشأت المائية المختلفة باستخدام المواد الحديثة .
- استخدام مواد عديمة القيمة كبديل لجزء من الأسمنت أو الركام في الخرسانة .
- رفع كفاءة الخرسانة باستخدام الألياف بأنواعها المختلفة.
- دراسة مواد البناء المختلفة لامكان تطويرها واختيار البدائل التي تتناسب مع وفرة المـــواد الخام المحلية للمنشآت المراد اقامتها .
- الوصول الى أنسب وسائل التبطين للمجارى المائية سواء في حالة جفافها أو بعد تشغيلها .
- حل المشاكل الخاصة بالانواع المختلفة من التربة سواء للمنشآت المائية أو الجسور .

سابعاً : مجال استخدام التقنيات الحديثة في مجال ادارة وتنمية الموارد المائيـــة والتـــدريب وتـــدعيم قدرات المركز الفنية والاداري

- استخدام التقنيات الحديثة مثل **Remote Sensing , GIS** في :
  - تطوير قاعدة البيانات الهيدلولوجية والهيدروجيولوجية.
  - إنتاج الخرائط الطبوغرافية والمصورة .
  - إنشاء قاعدة بمتكاملة للبيانات المساحية .
  - تحديد تغيرات مجرى نهر النيل .
  - الاستفادة من الظواهر الطبيعية للتنبؤ بالفيضان.
- استخدام النماذج الرياضية في المجالات المختلفة لادارة وتنمية الموارد المائية .
  - دراسة تطبيقات الذكاء الصناعي بالشبكات العصبية على الهندسة الجيوتكتيكية.

- استخدام شبكة الآنترنت في الحصول على المعلومات والتقنيات الحديثة في مجال ادرة وتنمية الموارد المائية .
- عمل برامج تدريبية في مجال اختصاص المركز للمهندسـين والفنـيين في الوزارة او الجهات الأخرى .
- دعم قدرات وامكانيات المركز الفنية والادارية وتدريب الافراد على كل مايستجد من التقنيات الحديثة.

الموارد الطبيعية والبيئة في اللغات الإفريقية

" لغة الهوسا "

د. صبري إبراهيم علي سلامه

مدرس لغة الهوسا وآدابها – قسم اللغات – معهد البحوث والدراسات الإفريقية – جامعة القاهرة

مقدمة

لا تزال اللغات الإفريقية (غير العربية) إلي يومنا هذا تقف حبيسة وراء جدارالصمت في عالمنا العربي ، اللهم إلاّ القليل النادر منها الذي عُرف الآن ، كلغة الهوسا ، والسواحيلية ، والأمهرية – حيث بدأت تطرق الأبواب لتأخذ مكانتها بين الدارسين العرب الذين تضائلت معرفتهم بهذه اللغات – وذلك علي الرغم من أننا الآن في القرن الحادي والعشرين – والذين كان من الأجدر بهم أن يعرفوها ويسبقوا إليها بدلاً من الغرب الذي لم يكد يترك لغة من لغات إفريقيا إلاّ وبحث فيها وكتب عنها منذ وقت سابق .

وإنه لمن دواعي سروري أن أرى القائمين علي " الندوة القومية لصون الموارد الطبيعية في مصر وإفريقيا " يطلبون المشاركة ببحث عن " الموارد الطبيعية ومكونات البيئة في اللغات الإفريقية " لمعرفة ما عبرت به هذه اللغات عن هذه الموارد .

وإنه لمن دواعي سرورى أيضاً أن أتقدم ببحث حول هذا الأمر في لغة الهوسا باعتبارها واحدة من أوسع اللغات الإفريقية انتشاراً .

إن الاهتمام بالموارد الطبيعية ومكونات البيئة أمر جدير بأن تعتني به كل اللغات الحية ، ولغة الهوسا واحدة من هذه اللغات التي أولت الموارد والبيئة اهتماماً عرضته بعض الكتابات الصادرة بهذه اللغة ، ولكننا سنعرض لها من خلال ما ورد عنها في كتاب "**Ikon Allah**" والذي يعني " قدرة الله " لمؤلفه الكاتب والأديب الهوساوي الحاج أبي بكر إمام ، ويقع كتابة هذا في خمسة أجزاء عالج منها المؤلف موضوعات كثيرة منها ما يتصل اتصالاً مباشراً بالمواردوالبيئة ، فتحدث عن الأرض والأمطار والزروع والحيوانات وغيرها .

ونحن من جانبنا قدمنا شرحاً مبسطاً ، مع عرض وجيز لمفهوم كلمتي " موارد – بيئة" .

هذا ويضم البحث النقاط الآتية :–

١– مقدمة .

٢– التعبير اللغوي عن موارد " الأرض – الماء – الهواء "

٣- التعبير اللغوي عن الموارد البيولوجيـة ، ويشـمل :- الإنسـان - الزواحـف والحشرات - الحيوان- النبات .

٤- خاتمة ونتائج .

التعبير اللغوي عن موارد " الأرض - الماء - الهواء "

قبل أن ندخل تفصيلياً في الحديث عن الموارد ، نود أولاً وفي إشارة سريعة التعريف لمفهوم مصطلحي " موارد طبيعية ، بيئة " في اللغة .

أ- كلمة " موارد طبيعية " . وتعني المناهل ، والمفرد منـها مَـوْرِدٌ ، ، وورد مَـوْرداً أى وُروداً والموارد هى الطريق إلي الماء .[1] وكلمة " طبيعة " مادهّا " طبع " ، والطبعْ والطبيعـة ، همـا الخليقة والسَّجيَّة التي جُبِلَ عليها الإنسان .[2] وحينما نقول " موارد طبيعية " فإنها تعني المناهـل ذات الخليقة والسَّجيَّة التيّ جبلت عليها . أى بطيعتها منذ أن خلقها الله .

ب- مصطلح " بيئة " : كلمة " بيئة " هى لفظة شائعة الاستخدام ، ويرتبط مدلولها بنمط العلاقة بينها وبين مستخدميها ، فرحم الأم بيئة الإنسان الأولي والبيت بيئة والمدرسة بيئة والحي بيئـة . والقطر بيئة ، والكرة الأرضية بيئة ، والكون كله بيئة ، ويمكن أن ننظر إلي البيئة مـن خـلال النشاطات البشرية المختلفة ، فنقول البيئة الزراعية ، والبيئة الصناعية ، والبيئة الثقافية ، والبيئة الصحية ، والبيئة الأجتماعية ، والبيئة السياسية .[3]

وفيما يلي نتناول تفصيلياً الحديث عن " الأرض - الماء - الهواء " في لغة الهوسا .

أولاً : مورد الأرض Kasa .

كلمة " أرض " في اللغة تعني الأرض التي يعيش عليها الناس ، وهى كلمة مؤنثة في اللغـة العربية ، وذهب بها أبن سيبويه إلي الموضع والمكان ، والجمع أراضي ، وأروض ، وأرضـون . ولهـا تفصيلات أخري وكلمة " أرض " في لغة الهوسا بمعني " **Kasa** " أى الأرض التي نعيش عليها ، كما تدل علي معني " التراب - الوطن - الدولة " .

وللأرض أهمية كُبري في حياة الكائنات عامة ، والأنسان خاصة ، فهى الكوكب الذي يعيش عليه الإنسان ، كما تعتبر هى أساس كل الموارد التي يعتمد عليها الإنسان في حياته ، وفيها يقول المولي سبحانه وتعالي :-

{ وإذ قال ربك للملائكة إني جاعل في الأرض خليفة........ }الآية - البقرة ٣٠

ويقول تعالي { والأرض وضعها للأنام * فيها فاكهة والنخل ذات الأكمام * والحـب ذو العصـف والريحان } الرحمن ١٢،١١،١٠ .

وفيما يتعلق بمورد " الأرض Kasa " يقول المؤلف في الجزء الأول من كتابه Ikon Allah وبأسلوب يحاول من خلاله إرجاع أصول الأشياء إلي الأرض – فيقول :

Mun ce duk abincimmu daga abubuwan da ke fitowa a kasa su ke zuwa . In ka yi shakka , tuna wani abu da muke ci , wanda ka ga daga kasa ya ke zuwa ba ?

لقد قلنا أن الأطعمة التي نأكلها مصدرها الأول هو الأرض . فإن كنت في شك من هذا فعليك أن تفكر أى الأشياء التي نأكلها ليست من الأرض ؟

A , Kun ji Abdu ya ce , " Nama " Hakanan ne , amma bi asalin ransa , Ai ka ga abincin dabba daga kasa ta ke samu . Daga kasa ta ke samun abin da za ta ci ta girma , har ita ma ta zama abinci agaremu .

نعم لقد سمعتم أن زميلكم عبده قال " اللحم " هو الذي ليس من الأرض ، نعم هكذا يكون ، ولكن عليك أن تتبع أصل حياته ، نعم ، لقد رأيت طعام الدابة قد نبت من الأرض ، فأكلته حتي كبرت ثم صارت هي الأخري طعاماً لنا .

Haka kuwa , in ka bi ko wane abinci asalinsa yana wurin kasa .

وهكذا الحال ، إذا تتبعت أصل كل شئ ستعلم أنه هو الأرض .

وفيما يتعلق بالأرض كمورد زراعي ، يقول المؤلف :-

Ko wane manomi ya san akwai kasa mai kyau , da kuma mara kyau . ya san wajibi ne ya nemi irin abin da zai shuka , ya shuka shi a wurin da kasa za ta ishe shi . In ya shuka bisa fa , ko bisa fako ba zai sami amfani ba .

أى :

كل فلاح يعرف التربة الخصبة من غيرها عديمة الخصوبة كما يعرف أنه من الواجب أن يبحث عن نوع المحصول الذي سيزرعه فيزرعة في المكان الذس تتناسب فيه طبيعة التربة معه . فإن زرع فوق صخرة ، أو في أرض قاحلة جرداء فلن يستفيد بها إطلاقاً ، أى أنها لن تنبت زرعاً لأنها غير صالحة للزراعة .

Ban da wannan ma , wajibi ne manomi ya san irin kasa da za ta da ce da ko wane iri , Misali , in zai shuka gyada , sai ya ga kasa mara danko . In zai shuka auduga , sai ya ga kasa mai danko ita ce abin nema . Shinkafa , yar fadama ce . In ka shuka gero wurin shinkafa . ba zai yi ba .

وعلاوة علي ما سبق ، فإنه ينبغي علي الفلاح أن يعرف جيداً طبيعة الأرض التي ستناسب أى محصول . فعلي سبيل المثال ، لو أنه سيزرع الفول السوداني ، فعليه أن "يختار" أرضاً غير ملتصقة المثام (سهلة) . وإذا كان سيزرع قطناً عليه أن يختار أرضاً صلبه السطح ، أى ملتصقة المثام ، فالأرز مثلاً – ابن الوادي ، بمعني أنه وليد المياه ، يحب المكان الملئ بالمياه ، فإذا زرع نبات الدخن مكان الأرز فلن يكون مناسباً .

وحول طبقات التربة ، يقول المؤلف :-

Inda za ka haka rijiya a gona , ko a daji , inda ke da akwai itatuwa , da farko abin da ka iske bakar kasa mai taushi . In ka wuce ta , sai ka zo ga wata iri mara taushi . Wannan zai ka yi zufa za ka huda ta , Launinta wata sa'a ja wata sa'a rawaya , In ka dube ta sasai , sai ka gan ta tsakuwa – tsakuwa , ba gari – gari ba ce kamar ta farko .

أى :

إذا كنت ستحفر بئراً في مزرعة ، أو في غابة ، أى في مكان توجد فيه أشجار ، فإن أول شئ ستجده تربة سوداء سهلة ، وإذا واصلت الحفر فستصل إلي طبقة من التربة صلبة وهذه الطبقة " الصلبة " لا تحفرها إلاّ ببذل الجهد والعرق ، وأحياناً يكون لونها أحمراً ، وأحياناً أخري يكون أصفراً ، وإذا نظرت إليها " التربة الصلبة " جيداً ، ستري أنها تربة حَصَوّية ، وليست ناعمة كالأولي .

ويستكمل حديثه قائلاً :

In ka ci gaba da haka sai ka tarad da marmara . Ta fi tsakuwa karfi , amma ba ta kai dutse ba . Daga nan , in ka yi gaba ka zo ga dutse . An kawo zango ke nan , don ba ka iya wucewa .

وإذا واصلت الحفر ، ستصل إلي طبقة زلطية ، وهى طبقة تفوق التربة الحصوية صلابة ، ولكنها لا تصل إلي صلابة الصخور ، ومن هنا إذا واصلت الحفر أيضاً ، ستصل إلي طبقة صخرية صلبة ، أى هذه هى نهاية المطاف حيث لا يمكن تجاوزها بالحفر .

وحول أصل الأرض الزراعية ، يقول المؤلف :-

Shimfadar kasa ta farko , ko yaushe sakewa ta ke yi , tana komawa sabuwa . Amma wannan sakewa tata tana yinta sannu sannu ne . Ga yadda ya ke aukuwa . Da farko , kasa duka asalinta daga duwatsu ta ke . Sa'a d da Sarki Allah ya halicci duniya , an ce ba kome ciki sai duwatsu .

طبقة الأرض الأولي دائماً ما تتغير فتعود جديدة مرة ثانية (أى تتجدد دائماً) . ولكن هـذا التغير الذي تحدثة يكون بطيئاً ، فهاك ما يحدث . في البداية الأرض كلها أصلها من الجبال الصخرية ، فعندما خلق الله الدنيا قيل لم يكن هناك منذ البداية إلاّ الجبال الصخرية .

Ba abin da iya tsirowa bisansu , sai wadansu 'yan kananan ciyayi wadanda kan mammanne a bisa fuskar dutse . Sannu sannu duwatsun nan suka fara tsattsagewa , suna babballewa . Ruwa shi ke shiga cikin tsaguwar , ya sa ta ta kara budewa .

فلا شئ يستطيع أن ينمو فوقها ، إلاّ بعض النباتات الصغيرة التي تلتصق علي قمم الجبال .

وببطء هذه الصخور الجبلية بدأت تتصدع ، وتتناثر . فدخل الماء في هذه الشقوق ، ثم جعلها تـزداد اتساعاً .

Ta haka ta haka , har duwatsun nan su babban gare , su farfashe su koma kanana , su kuma kananan su kara farfashewa , su koma maremari da tsakuwa .
Tsakuwar ta rugurguje , ta koma rairayi . Wani irin dutse kuma in ya fara farfashewa ba ya tsayawa sai ya koma yumbu .

أى :

وهكذا حتي تتشقق هذه الصخور وتتكسر ، ثم تعود صغيرة الحجم ، وأيضاً الصغيرة تزداد تصدّعاً ، فتعود زلطية وحصوية .

والتربة الحصوية دُكّت ، وعادت رملية . وهناك أحد أنواع الصخور أيضاً إذا بدأ يتصدع لا يبقي علي حاله بل يعود طيناً .

Sa'ad da kasa ke wannan sauyawa , ruwa shi kuma ya kan rika fid da wadansu abubuwa kanwa – kanwa daga cikin dutse . Wadannan duk sai su shiga cikin kasa , su kara mata kyau ga noma .

يعني :

حينما تحدث الأرض هذا التغير : فالماء عادة يخرج ببعض الأشياء الحماة من الجبل . وكـل هذا يدخل الأرض ، فيزيد من خصوبتها .

ثانياً : مورد الماء **Ruwa** :

الماء في اللغة المائع المعروف ، أصله (موه) ، وتصغيره (مويه) ، والنسب إليه (مائي – ماؤى – وماهى) ، والجمع منه (مياه – أمواه) ، ومنه ماء الورد ، وماء الوجه أى رونقه ونضارته .[٥]

وإذا كنا هنا نتحدث عن الماء باعتباره مورداً طبيعياً ، فجدير بنا أن نقول أن "الماء" هو من أول المخلوقات التي أبدعها الله وأظهرها إلي حيز الوجود . [٦]

والماءُ أساس الحياة وشريانها ففيه يقول المولي سبحانه وتعالي :

{ هو الذي أنزل من السماء ماءً لكم فيه شراب ومنه شجرٌ فيه تسيمون * ينبت لكم به الزرع والزيتون والنخيل والأعناب ومن كل الثمرات إن في ذلك لأيةً لقوم يتفكرون }النحل آية ١٠-١١ .

وإلي جانب أن الماء هو أصل الحياة ، فإنه أيضاً له خاصية التطهير والتنظيف .

ومورد " الماء **Ruwa** " لا تخفي علي أحد أهميته ، فهو عنصر أساسي للحياة ، لكل الكائنات وصدق الله إذ يقول { وجعلنا من الماء كل شئ حي ...... } الأنبياء – آية ٣٠

وأثبتت الدراسات الحديثة أن الماء يشكل نحو ٧٠% من وزن معظم النباتات والحيوانات ، بما فيها الإنسان . [٧]

وتعني كلمة " ماء " في لغة الهوسا " **Ruwa** " ، وتأتي من خلال إسنادها لتشير إلي عدة معان ، منها علي سبيل المثال :

ماء الشرب **Ruwan sha**	– ماء الرجل **Ruwan namiji**
ماء المرأة **Ruwan mace**	– جنسية مزدوجة **Ruwa biyu**
ماء السماء **Ruwan sama**	أى " ماء المطر " . [٨]

وحول هذا المورد " الماء **Ruwa** " كتب المؤلف يقول :

Dukan abu mai rai yana bukatar ruwa . Itatuwa , ciyayi , dabbobi , duk ba su yi sai da ruwa . A daji im maraice ya yi . sai namun dawa duk su nufi koramu su sha ruwa . A kurmi , in ka je inda ruwa ya ke , za ka iske tsuntsaye su ma sun taru , sun zo shan ruwa .

أى : كل كائن حي يحتاج إلي الماء ، النباتات والأعشاب ، والدواب ، جميعها لا تستطيع الحياة إلاّ بالماء . ففي الغابة إذا حان وقت المساء ستري الحيوانات البرية جميعها تتجه إلي البرك المائية لتشرب الماء . وفي الغابات أيضاً إذا ذهبت حيث مكان الماء ، ستري أن الطيور قد تجمعت وأتت لتشرب الماء .

ولبيان أهمية هذا المورد " الماء **Ruwa** " بالنسبة للإنسان خاصة يقول المؤلف :-

Mu kuma 'yan Adam , cikin abubuwan da mu ke bukata a duniya , im mun ce iska ita ce lambawan , to , ruwa shi ne lambatu . Amma ba ruwa , yana iya kwana uku , kila har hudu , amma sa'an nan dole ko dai ya sha ruwa ko kuwa ya mutu .

أى : ونحن الآدميون أيضاً ، من الضروريات التي نحتاجها في حياتنا ، إذا قلنا أن الهواء هـــو أولها ، فالماء هو ثانيها . فبدون الماء لا يستطيع الإنسان أن يعيش سوى ثلاثة أو أربعة أيـــام فقـــط ، عندها يلزم عليه أن يشرب الماء وإلا سيلقي حتفه .

ويقول أيضاً :

Ruwa ya fi abinci zama wajibi ga dan Adam .Domin mutum na iya yin sati uku , har hudu , ba ci in dai yana samun ruwa . Masu azumi su ne shaidummu a wannan . Magariba ya yi , ruwa za su fara nema kafin su nemi abinci . Amma dai duk ba wanda ya san iyakar darajar ruwa ga dan Adam sai masu tafiya cikin hamada .

أى : الماء يفوق الطعام من حيث كونه ضرورياً للإنسان ، وذلك لأن الإنسان يســـتطيع أن يبقي علي قيد الحياة لمدة ثلاثة أسابيع أو أربعة بدون طعام ولكن بشرط توافر الماء لديه ، والصائمون هم شهودنا علي هذا ، فإذا حان وقت الإفطار فإن أول شئ يطلبونه هو الماء قبل الطعام ، وليس هناك من يعرف حدود أهمية الماء للإنسان إلاّ المسافرين في الصحراء . ولتعظيم أهمية مورد " الماء Ruwa " يحكي المؤلف قصة واقعية عن إحدى سرايا الجيش الكتائب المصرية التي كانت في طريقها إلي أحـــد المواقع عبوراً بالصحراء فيقول :-

'Yan shekarun nan da suka wuce , wani kamfani na sojan Masar suka shiga hamada , suna maci za su ketare tare da jagabansu , Suna cikin tafiya , sun yi kwanaki , sai ruwa ya yanke musu kishirwa ta fara gigita su . Ran nan sai suka ga kawalwalniya .

To , cikin dimautar da kamfanin can suka yi sabo da kishirwa , da suka hangi wannan kawalwalniya , Suka ce " A ! Ga ruwa can . Mu juya ! Jagabansu ya ce , Ba ruwa ba ne , Mu yi gaba ! Suka ce , "Ba ruwa ba ne , in ji wa ? " Suka hau da zagi . Sai fada ya tashi , Suka kashe shi . Suka ruga wajen kawalwalniya , ba su iske kome ba sai rairayi . Suka komo wai su kama hanya , suka rasa ta . Wanda ya san hanyar sun kashe shi , shi ke nan , suka yi ta yawo cikin hamada , su yi gaba su yi baya har duk suka mutu . Kishirwa ta kashe su . Sai bayan wata shida aka iske kasusuwansu bargaja .

وهذا يعني :

" أنه في الأعوام القليلة الماضية (في النصف الأول من القرن العشرين) كانت إحدي الفرق العسكرية المصرية تعبر الصحراء في طريقها إلي هدفها المقصود ، وكان جنود هذه الفرقة يسيرون مع قائـــدهم ، فظلوا يسيرون في الصحراء لعدة أيام ، ، وفجأة نفذ منهم الماء ، وبدأ الظمأ يستحوذ عليهم ، ففـــي ذات يوم رأوا ظاهرة السراب فظنوا أنها ماء ، وفي ظل حيرتهم التي هم فيها بسبب الظمأ ، فعندما رأوا .

هذه الظاهرة صاحوا قائلين ، ها هو الماء ، لنعود إليه ، فقال لهم قائدهم إن ما ترونه ليس ماءً ، فانهالوا عليه سباً وقذفاً وقالوا له : من قال هذا ؟ " وضربوه حتي الموت ، وانصرفوا مسرعين في تجاه ما ظنوا أنه ماء فعندما وصلوا (بعد أن قطعوا سيراً طويلاً) لم يجدوا ماءً ، فكان السراب ، فحاولوا العودة مرة ثانية ، لكنهم ضلوا الطريق لأن من يعرفه " هو قائدهم " قد قتلوه ، فتاهوا في الصحراء ذهاباً وإياباً باحثين عن الطريق لكنهم ضلوه ، فاشتد عليهم الظمأ وماتوا جميعاً ، وبعد مضي حوالي ستة أشهر عثر علي رفاقم مبعثراً في الصحراء .

وفي بلاد الهوسا ، في فصل المطر والذي يعرف بـــ " **Lokacin damina** " تري الناس بعد سقوط المطر يهنئون بعضهم البعض ويباركون سقوط المطر ، فيقولون :

كيف حال المطر ؟ **Yaya ruwan sama ?**

فيجيب الآخرون :

الحمد لله ، لقد سقط المطر بغزارة . **Ruwa ya yi sossai .**

ولعظيم أثر " الماء **Ruwa** " وأهميته في مجتمع الهوسا ، نراهم وقد استخدموه في حكاياتهم الشعبية ، فأصبح مضرب الأمثال لديهم لكل ما هو عظيم ، فنسج الأديب الهوساوي بعضاً من الحكايات التي تتصل أتصالاً مباشراً بالماء ، منها علي سبيل المثال ما يلي :

١- حكاية ماء الشفاء **Ruwan Bagaja** للأديب الهوساوي الحاج أبي بكر أمام [٩].

٢- حكاية ماء الشفاء **Ruwan Bagaja** للأديب الهوساوي إبراهيم يارو يحي .

والحكايتان تختلفان في مضمونهما إلاّ أن الغاية فيهما هى " ماء الشفاء " الذي يعالج السقم ويشفي من الأمراض . [١٠]

ثالثاً : مورد الرياح **Iska**:

الريح في اللغة مادتة " روح " ، والريح يعني نسيم الهواء ، وكذلك نسيم كل شئ ، وهـى كلمة مؤنثة . والرِّيحَةُ طائفة من الريح ، ويجوز فيها أن يدل الواحد على ما يدل عليه الجميع . [١١]

وفى الرياح وفائدها يقول المولى سبحانه وتعالى : ((وهو الذى يرسل الرياح بشراً بين يدى رحمته حتى اذا أقلت سحابا ثقالا سقناه لبلد ميت فأنزلنا به الماء فأخرجنا به من كل الثمرات ، كذلك نُخرج الموتى لعلكم تذكرون)) الأعراف -٥٧- ومما عبرت عنه الكتابات الهوساوية عن مـوارد ((الهواء **Iska**)) ، يقول المؤلف نفسة في كتابه هذا :

Abaya mun rigaya mun zana wadansu abubuwa da mu ' yan adam mu ke bukata don zama wannan duniya tamu .Muna son abinic , da ruwa ,da wurin kwana Amma duk cikin abin da rai ke bukata ,iska ita ce ta fari .In an haifi yaro , abin da zai

fara bukata a duniya shi ne iska .Wajibi ne ya shaki iska , ya cika huhunsa da ita .Im bai samu ba kuwa ,sai ya koma .

وهذا يعنى :" فيما سبق لقد وضحنا الاشياء التى نحتاجها نحن أبناء آدم من أجل أن نعيش فى دنيتنا هذه . فنحن نريد الطعام ، ونريد الماء ، ومكان الإيواء ولكن من بين هذه الأشياء جميعها والتى نحتاج إليها يأتى الهواء فى طليعتها جميعا . فإذا ولد مولود فإن أول شئ سيحتاج إليه فى حياته هو الهواء. فيجب عليه أن يستنشق الهواء ويملأ به رئتيه فإن لم يفعل ، فسوف يموت.

ويقول أيضاً :-

Ba mutum kadai ba, dabba duk haka ta ke . Abinci da sauran bukata duk iyaye su ke nema wa jariri , amma iska shi ke neman abinsa da kansa .

أى ليس الإنسان وحدة فقط (الذي يحتاج الهواء) ، ولكن الدواب جميعها شأنها هكذا . فالطعام وباقي المتطلبات جميعها يحضرها الوالدان للطفل الرضيع ، ولكن الهواء فقط (الطفل الرضيع) الذي يطلبه لنفسه بنفسه .

ويقول أيضاً :-

Ran da mutum ko daba ta daina numfashi , ran nan rai ya fita .

أى : وفي اليوم الذي يتوقف فيه الإنسان أو الحيوان عن التنفس ، فعندئذ سوف يفارق الحياة .

وعلاوة علي أهمية " الهواء **Iska** " بالنسبة للإنسان والحيوان وغيره ، ينتقل المؤلف إلي إبراز أهميته أيضاً بالنسبة لـ"النار **Wuta** " التي يستخدمها الإنسان في حياته ويعتمد عليها في كثير من الجوانب الحياتية ، فيقول :-

Yadda abu mai rai duk ya ke bukatar iska , haka wuta ita ma ba ta kamawa sai da iska .

أى مثلما يحتاج كل كائن حي إلي الهواء . فالنار أيضاً لا يمكن لها أن تشتعل بدون الهواء .

ثانياً : التعبير اللغوي عن الموارد البيولوجية :

تشمل الموارد البيولوجية كلاً من (الإنسان – الحيوان – النبات – الزواحف – الحشرات) .

وفيما يلي نوالي الحديث عنها تفصيلياً علي النحو التالي :-

أ- الإنسان **Mutum** .

الإنسان في اللغة يعني " ابن آدم " والجمع منه " الناس " ، والإنسان أصله " إنسيان " ، وسمي " بإنسان " لأنه عهد إليه فنسي . والإنسان يعني أيضاً " إنسان العين " ، والإنسان السيف والسهم حدهما [١٢].

والإنسان علي الرغم من أنه مخلوق ضعيف ، إلاّ أن الله عز وجَلّ كرمه بأن أنعم عليه بنعمة "العقل" ، وكرمه أيضاً بأن جعله خليفة له في الأرض ، وفي هذا يقول المولي سبحانه وتعالي :

{ وإذ قال ربك للملائكة إني جاعلُ في الأرض خليفة ...... } البقرة – آية ٣٠.

ويقول أيضاً { وإذ قلنا أسجدوا لآدم فسجدوا إلاّ إبليس أبي واستكبر وكان من الكافرين } البقرة – آية ٣٤ .

ولم يدع الله الإنسان هكذا بل أنعم عليه أيضاً بنعمة العلم ، وفي هذا يقول سبحانه :

{ وعلمَّ آدم الأسماء كلها ...... } البقرة – آية ٣١ .

ويقول سبحانه{الرحمن * عَلمَّ القرآن * خلق الإنسان * علمه البيان} الرحمن ١-١٢-٣-٤

وحول مورد " الإنسان **Mutum** " يقول المؤلف :-

A cikin dukan halitta ta duniya , mutum shi ya fi kowa rashin dabarar zaman duniya , sa'ad da aka haife shi . Amma maimakon wannan , sai Allah ya ba shi hikmar koyo fiye da dukan sauran halitta .

أى : إنه من بين جميع المخلوقات في الدنيا بأكملها ، الإنسان هو أقل الكائنات إدراكاً بالحياة الدنيا ، وذلك في وقت ولادته ، ولكن عكساً لهذا ، نجد أن الله قد منحه حكمة التعلم التي يتميز بها علي جميع المخلوقات .

وحول تغلب الإنسان بوصفه عاقلاً علي مشقات الحياة ، يقول الكاتب :

Tsaron kai shi ne asalin ci gaba a duniya . Shi ya sa dan Adam ya samo dabarar noma da kiwo , da sana'a iri iri . shi ya sa ya tara dukiya , ya gina birane , ya samo dabarar tafiya ta kasa , da ta ruwa , har da ta sama . Shi ne ya sa ya nemi magunguna , da makamai , da dabarar sa dabbobi su yi ma a bauta , da dai ilmi iri iri .

وهذا يعني :

إن مسألة الدفاع عن النفس هى الأصل في البقاء ، فهي التي جعلت الإنسان يبحث ويخترع الزراعة ، والرعي ، والصناعات المتعددة ، وهى التي جعلته يكنز الأموال ، ويبني المدن ، ويخترع وسائل السفر والترحال البرية ، والبحرية ، والجوية ، وهو الذي جعله يبحث عن العلاج ، ووسائل الدفاع (الاسلحة) ، وكذلك امكانية تطويع الدواب له وذلك بالعلوم المختلفة .

ويتابع قائلاً :

Anan kun gane bambanci tsakanin dabba da mutum . Sarki Allah ya ba mutum iko ya yi zabe , ko ya aikata aikana gari , ko ya aikata mugu , Amma ita dabba ko yau he halin da Allah ya halicce ta da shi , shi za ta bi .

يعني : ومن هنا لقد علمتم الفرق بين الإنسان والحيوان . فالله عز وجل قد منح الإنسان قدرة الأختيار ، أما أن يعمل خيراً ، وإما يعمل شراً ، أما الدابة فدائماً هى علي الحال الذي خلقها الله عليه ، فهي مُسَيَّرة .

ويقول أيضاً :

Dan Adam yana zato shi halitta ce iri dabam .Har in ka gwada shi da dabboi sai ya ce ka ci mutuncinsa . Mun sani kam , Sarki Allah ya yi mana baiwa , wadda bai yi wa ko wace halita ba .

أى : إن الإنسان ليعتقد أنه مخلوق متميز ، لدرجة أنه إذا قارنته بالحيوان يقول أنك انتهكت آدميته ، ولقد علمنا أن الله سبحانه وتعالي وهبنا هبة هى تلك التي لم يهبها لمخلوق آخر .(وهي نعمة العقل) .

ب- الحيوان **Dabba** :

الحيوان في اللغة هو اسم يقع علي كل شئ حى . وقال قتادة هى الحياة ، وقال الأزهرى إن من صار إلي الآخرة لم يمت ، ومن دام حياً فيها لم يمت ، والحيوان عين في الجنة ، وقال ماءُ في الجنة لا يصيب شيئاً إلاّحيَّ بإذن الله تعالي .(١٣)

وكلمة " حيوان " تعني في لغة الهوسا " **Dabba** " وهى كلمة من أصل عـــربي " دابـــة " وتجمع في الهوسا علي " دواب – **Dabbobi** " أى حيوانات " .

ومن الحيوانات الأنعام التي ينتفع بها الإنسان في حياته ، وفيها يقول المولي سبحانه وتعالي :

{ والأنعام خلقها لكم فيها دفءٌ ومنافع ومنها تأكلون * ولكم فيها جمالٌ حين تريحون وحين تسرحون * وتحمل أثقالكم إلي بلد لم تكونوا بالغية إلاّ بشق الأنفس إنّ ربكم لرؤفٌ رحيم * والخيل والبغــال والحمير لتركبوها وزينةً ويخلق ما لا تعلمون } . النحل ٥-٦-٧-٨ .

ويقول سبحانه في موضع آخر :

{ وإن لكم في الأنعام لعبرةً نُسقيكُم مما في بطونه من بين فَرْثٍ وَدَمٍ لبناً خالصاً سائغاً للشاربين }النحل ٦٦

وحول مورد " الحيوان **Dabba** " تتناول المؤلف علي النحو التالي :-

أولاً : الأبقار **Shanu** :

Saniya ba a halicce ta tare da mutum ba . Da , a daji ta ke kamar bauna . Amma ana zaton tana cikin namun daji na farko da Adam ya mayar na gida .

أى : إن البقرة لم تخلق مع الإنسان . ومن قبل وفي الغابات كانت تعيش مثل الجاموس البري . ولكن كان يُعتقد أنها من بين الحيوانات البرية الأولي التي استأنسها الإنسان حتي أصبحت حيوانات أليفة .

A nan mun san shanu iri biyu , masu tozo da marasa tozo .

وتنقسم الأبقار في نوعين ، أبقار ذات سنام وأخري ليس لها سنام .

Saniya tana da doguwar wutsiya ta korar kuda . Tana da kuma kunnuwa masu fadi , suna taimakonta korar kuda da su ke ta damumta afuska .

وللبقرة ذيل طويل تطرد به الذباب . وكذلك لديها أذنين عريضتين ، يساعدانها علي طـرد الذباب الذي يضايقها كثيراً حينما يأتي علي وجهها .

Kahonin sainya su ne makamanta na dauki da na tsaron kai .

وقرنا البقرة هما سلاحها الذي تدافع به عن نفسها .

ثانياً الجاموس Bauna :

Bauna saniya ce , sai dai ita ta ki yarda da dan Adam . Duk abin da kuka ji mun ce na game da jikin Saniya , to , bauna ma ta shiga .

يعني : الجاموسة من فصيلة الأبقار ، إلاّ أنها تأبي أن يطوعها الإنسان (علي الرغم من تطويعه لهـا) . وكل شئ ذكرناه حول جسم البقرة ، ينطبق علي الجاموسة .

ثالثاً الماعز والأغنام Awaki da Tumaki :

Awaki da tumaki danginsu daya ne da shanu . Suna da kaho , amma galibin inda su ke amfani da su sai wurin fada da 'yanuwansu .

الماعز والأغنام من نفس فصيلة الأبقار ، ولها أيضاً قرون . ولكن في الغالب ما يستفاد منهما في حالة ما إذا كانوا يتناطحون مع بعضهم البعض .

Tumaki da awaki dabbobi ne masu son zumunta .

أى : الماعز والأغنام من الدواب الأليفة والتي تحب العشير (ويقصد به الراعي) .

رابعاً الإبل Rakumai :

Rakumi yanzu ba ya zaune a daji , ya zama na gida . A cikin dabbobi , rakumi shi ne babban misali na wanda ya dace da wurin zamansa . Rakumi yana iya tafiya cikin zafin hamada . kwana da kwanaki bai sha ruwa ba .

أى :

لم تعد الإبل الآن من حيوانات الغابة ، حيث أصبح حيواناً أليفاً . ومن بين الـدواب يـأتي الجمل مثال لذلك الحيوان الذي يستطيع أن يتأقلم مع المكان الذي يعيش فيه .

والجمل يستطيع أن يسير في الصحراء الحارة أياماً عديدة دون أن يشرب الماء .

Yadda shannu su ke ga Baroro , haka rakumi ya ke ga mazauna hamada , su Azbinawa da Bugaje da Larabawan daji . Wadannan kabilu rakuma su ne abincinsu , su ba su nono , su ba su nama .

ومثلما تنتفع قبيلة " بارورو " بالأبقار ، فإن الإبل تكون هكذا بالنسبة لقاطني الصحراء ، الذين هم قبائل " أزبيناوا ، بوجاجي ، وعرب الصحراء ، فهذه القبائل تُعد الإبل هي طعامهم الأساسي ، حيث تمدهم بالألبان . وتمدهم باللحوم .

جـ – مورد النباتات **Tsire – Tsire** :

النبات في اللغة هو كل ما أنبت الله في الأرض ، وكل ما نبت في الأرض فهو نبتٌ ، يقال أنبت الله النباتات إنباتاً . (١٤)

والنبات تعني كل ما ينبت في الأرض فتشمل المحاصيل بأنواعها والثمار على مختلف أشكالها ، ومنها ما يكون غذاءً للإنسان ، وآخر للحيوان .

وكلمة " النبات " في لغة الهوسا تعني " **Tsire – Tsire** " ، وهي تعني في هذه اللغة ما شرحناه أعلاه .

وحول مورد النبات **Tsire – Tsire** يقول المؤلف :

Abin da mu ke ci duka asalinsa daga kasa ya ke fitowa . Ko dai mu ci su yadda suka tsiro , ko 'ya'yansu , ko ganyensu , ko saiwoyinsu , ko kuwa dabbobi su ci su , mu kuwa mu ci dabbobi . Da ba don tsire – tsire ba , da dan Adan da dabba ba wanda za iya zama a duniya .

أي : إن الأرض هي أصل كل ما نأكل حيث خرج فمهما . فمنها كان الخارج منها سواء أكان نباتات أو ثمار ، أو أوراق ، أو جذور ، فإن أكلته الدواب ، فنحن نأكلها أيضاً . ولا يستطيع أحد سواء أكان إنسان أو حيوان أن يحيا بدون النباتات .

Ban da ba da abinci ga mutane da dabbobi , tsire – tsire suna da amfani agare mu ta hanyoyi da yawa . Galibin kayan da mu ke amfani da su a gida , da makarantu , da kasuwa , duk daga tsire – tsire aka same su . Tabarmar da mu ke zama kanta , takardar da mu ke rubutu bisanta , tawadar da malam ke rubutu da ita , tufafin da mu ke sawa ... duk asalinsu tsire – tsire ne .

فعلاوة على كون النباتات طعاماً للإنسان والحيوان ، فإننا أيضاً نستفيد بها في نواحي كثيرة ، حيث أن أغلب المتاع الذي نستفيد به في البيت ، والمدارس ، والسوق كله من النباتات . فالحصيرة التي نجلس عليها ، والورقة التي نكتب فيها ، والحبر الذي يكتب به المعلم ، والملابس التي نرتديها وغيرها ... كل ذلك من النباتات .

Magani kuma galibi duk daga tsire – tsire a ke samunsu . un da tsofaffi sun san wannan amfani . Masu hikima sun bincika , sun sami magunguna iri iri daga tsire – tsire . Ko maganin likita da ku ke gani a kwalabe , da yawa asalinsu daga tsire – tsire .

أى : وغالبية الدواء أيضاً من النباتات . فمنذ أن عرف القدماء هذه الأهمية . بحث العلماء كثيراً حتي استخرجوا أدوية مختلفة من النباتات . حتي دواء الطبيب الذي نـــراه في الزجاجــة أيضـــاً ، أغلبـــه مستخلصُ من النباتات .

ويختتم المؤلف بقوله عن النباتات :

Wadansu tsire – tsire Allah ya ba su hure masu kyaun gani , da kanshi , da faranta zuciya . Irinsu mu ke so mu shuka a gidajemmu da kewayen makaranta .

أى : لقد منح الله بعض النباتات زهوراً ذوات منظر جميل . ورائحة طيبة ومنظراً يُدخل الســـرور إلي القلب ، فعرفنا هذه الأنواع وزرعناها في بيوتنا وأحطنا بها مدرستنا .

د – الزواحف والحشرات :

كلمة " زواحف " في اللغة كلمة جمع ، مفردها " زاحف " ، والزاحفات من الحيوان هي التي تدب الأرض زحفاً كالسحلفاة . و " زحف " دب علي مقعدته أو ركبتيه قليلاً قليلاً(١٥)

أما كلمة " حشرة " فتجمع علي " حشرات " ، وهى هوام الأرض مما لاسم لـــه ، وقـــال الأصمعي الحشرات والأحراش والأحناش واحد وهى هوام الأرض .(١٦)

ومما أورده المؤلف عن " الزواحف والحشرات " يمكن بيانه علي النحو التالي :-

أولاً : الزواحف Masu jan ciki : ونذكر منها نوعاً واحداً فقط وهو " الثعابين " .

الثعابين Macizai :

Maciji ba shi da gaba kamar yawancin dabbobi . Kuma kun sani sauran dabbobi suna da kafafuwansu a waje , amma maciji nasa kafafuwa cikin jikinsa su ke . Su ne hakarkarinsa .

ليس للثعابين عضلة مثل معظم الدواب ، فلقد عرفتم أن باقي الدواب لديها أقدام خارجية ، ولكن الثعبان له أقدام داخل جسده ، هى التي تمثل ضلوعه في ذات الوقت .

Bakin maciji yana da siffa wata iri wadda ke taimakonsa hadiye katon abu .

ولفم الثعبان خاصية من نوع معين تمكنه من ابتلاع أى شئ ضخم .

Idon maciji ba shi da fata , ko yana barci ba ya iya rufe su . Amma harshensa shi ke yi masa aiki maimakon kunne da hanci .

إن عينا الثعبان ليس لهما جلد ، حتي عندما ينام فلا يستطيع أن يغمضهما . وأمـــا لســـانه فيؤدي له دور الأذن والأنف .

Wadansu suna zato wai dafin maciji a wutsiyarsa ya ke . In ya yi sara , wai sai ya kada ta , dafi ya zo . Wannan duk ba haka ba ne . Dafin maciji a cikin kansa ya ke cikin wata 'yan jaka – jaka kamar mafitsara .

يعتقد البعض أن سُمَّ الثعبان يكمن في ذيله ، فإن لدغ " أحداً " فعندئذ يجتمع السُمَّ ويأتي من الذيل . ولكن هذا كلام غير صحيح . فَسُمَّ الثعبان يوجد في رأسه في داخل جيوب صغيرة علي هيئة الحويصلات .

وحول أنواع الثعابين قال المؤلف :-

Ba ko wane irin maciji ya ke da dafi ba : Damatsirai – danyar ciyawa – miyaruwa – watau tururubi .

أى : ليست كل أنواع الثعابين سامة . فيها هـي بعـض الثعـابين خاليـة مـن السـموم ، مثـل **Watau tururubi** ، **Miyaruwa** ، **Danyar** ، **Ciyawa** ، **Damatsirai** وكلها أنواع من الثعابين .

Wadansu su kuma su ne miyagu , masu dafi : Kumurci , gansheka , tandara , tsadaraki , kasa -- kasa , kasa , gajera – ita ce kububuwa .

والبعض الآخر أيضاً شريرة جداً ، وهـي ثعـابين سـامة ، وهـي : **Kumurci** ، **gansheka** ، **tandara** ، **tsadaraki** ، **kasa – kasa** ، **kasa** ، **gajera** التي هي **kububuwa** وكلها أنواع من الثعابين السامة .

ثانياً : الحشرات Kwari :

نتحدث فيها عن نوعين ، البعوض **Sauro** ، والنحل **Kudan zuma** .

أ- البعوض Sauro .

يقول المؤلف :

Bari mu fara da sauro , abokin gabarmu lambawan . A ko ina cikin duniya , kusan duk inda ka ga ruwa ka ga sauro . Sauro mugun makwabci ne . Ga damuwa , ga hana barci . Babban aibinsa shi ne watsa cuta .

أي :

دعونا نبدأ الحديث عن البعوض ، الذي هو عدونا الأكبر والأول . ففي كل مكان في الدنيا ، بالقرب من المياه تري البعوض . فالبعوض جار سئ ، فحيثما يكون تكون المضايقة ، الإزعاج والقلق ، ومن عيوبه الكبري أنه ناقل للأمراض .

ويقول أيضاً عن أنواع البعوض :

Iri – iri sauro yawa gare su , Malamai masu kidaya har sun kai ga samun iri dubu dabam dabam . Ko wane iri kuwa da sunansa . Amma mu nan yanzu za mu ba ku iri uku kawai . Su ne :

1- Sauro mai kawo zazzabin Malaria .
2- Sauro mai kawo shawara (Yellow Fever) .
3- Sauro mai kawo Tundurmi .

أي :

بالنسبة للبعوض فهناك أنواع عديدة منه ، فلقد أحصي العلماء هذه الأنواع حتي وصلوا إلي ألف نوع منه ، كل نوع مختلف عن الآخر . ولكل نوع اسمه الخاص به . ولكننا الآن سنورد لكم ثلاثة أنواع فقط منه ، هي :-

١- البعوض المتسبب في مرض حمي الملاريا .
٢- البعوض المتسبب في مرض حمي الصفراء .
٣- البعوض المتسبب في مرض تورم القدمين .

ثم استرسل المؤلف شارحاً لكل نوع منها .

ب- النحل Kudan zuma :

النحل مملكة عجيبة وتدعو للدهشة ، وتحتاج أن يقف عندها أصحاب العقول ليتأملوا في عجيب صنع الله حيث هذا المخلوق الصغير ، الذي قال عنه رب العزة في كتابه العزيز :

" وأوحي رَبكَّ إلي النحل أن اتخذي من الجبال بيُوتاً ومن الشجر ومما يعرشون * ثم كلي من كل الثمرات فاسلكي سُبُل ربك ذللاً يخرج من بطونها شراب مختلف ألوانه فيه شفاء للناس إن في ذلك لأية لقوم يتفكرون " النحل ٦٨-٦٩ .

وكلمة " نحل " في لغة الهوسا هي كلمة مركبة من كلمتين هما :-

" **kuda** " وتعني " ذباب " ، و "**zuma** " وتعني " عسل " والتركيب " **Kudan zuma** " معناه " ذباب العسل " أي " النحل " .

وحول هذه المملكة العجيبة أفاض المؤلف في الحديث عنها إلاّ أننا هنا سنوجز فيه بقدر المستطاع .

A cikin garin kudan zuma , watau amya , akwai jama'a iri uku . Ga dai uwarsu duka , ita ce sarauniya , ga maza , ga ma'aikata .

أى : في داخل مدينة النحل ، أى خلية النحل ، هناك ثلاثة طوائف فها هى أمهم جميعهم ، إنها الملكة ، وها هى الذكور ، وها هى الشغَّالات .

Sarauniyar ba ta da wani aiki a duniya sai yin kwai . Ko abinci ba ta ci da kanta , sai arika ba ta a baki . Mazan kudan zuma su kuwa ba su wani aiki a garin .

أى : الملكة لا تعمل شيئاً علي الإطلاق في حياتها سوي أنها تبيض ، حتي الطعام لم تأكله بنفسها ، إلاّ أن يوضع لها في فمها " تُطعمُ الطعام " . وذكور النحل لا يعملون شيئاً في الخلية .

Aikin duk ma'aikatan ke yi . Su ke yin kaki , su ke gina dakuna , su ke renon 'ya'ya , su ke tara abinci .

إن العمل كله تؤديه الشغَّلات . فهن اللائي يفرزن العسل ، وهن اللائي يبنين الفتحات الشمعية ، وهن اللائي يلتقطن رحيق الثمار ، وهن اللائي يجمعن الطعام .

In sun ga gidan zai faye zafi kuma , su kan rika yin fita don zafin ya rage . In sun ga zai faye sanyi , sai su curu , su yi ta motsi , ta haka su ke sa shi ya kara zafi .

أى : فإذا رأين أن المكان ارتفعت درجة حرارته فعلي الفور يخرجن حتي تنخفض درجة الحرارة . أما إذا رأين أن درجة الحرارة أنخفضت لدرجة البرودة ، فعلي الفور يتحركن بأجنحتهن محدثات صوت داخل الخلية يعمل علي تدفئتها .

ونكتفي بهذا القدر من الحديث عن مملكة " النحل " التي تعد من أعجب مخلوقات الله .

وفي دعوة كريمة للحفاظ علي البيئة وجمالها يقول المؤلف :-

Ga wani abin mamaki na game da iska . Mun ce ko yaushe muma shakar iska mai kyau , muna debe abin da jiki ke so a ciki , muna fitad da mara kyau . Haka duk dabbobi ke yi a duniya tun da aka haliccesu . To , in haka ne , watau kullum iska mai kyau ragewa ta ke yi ke nan , mara kyau tana karuwa . Nan gaba , im mai kyau ta kare , kuma sai tashin duniya ? Ko yaya ke nan ?

أنه هناك من العجائب بالنسبة للهواء . فلقد قلنا أنه دائماً نستنشق الهواء النقي ، ونستخلص منه ما يرده الجسد بداخله ، ونخرج بعديم الفائدة (أى هواء الزفير الملئ بثاني أكسيد الكربون) . تتفعل الدواب جميعها علي سطح الأرض ومنذ أن خُلقت . وطالما الأمر كذلك فهذا يعني أن الهواء النقي ينقص يوماً بعد يوم والفاسد يزيد . فهل مستقبلاً أن الهواء النقي سينفذ ، وعندئذ ستقوم القيامة ؟

Manyan malamai masu tsananin hikima su suka binicka , har suka samo amsar wannan tambaya . Ga ta : Da mu da itatuwa wata irin musaya mu ke yi mai ban mamaki . Iska mara amfani da mu ke fifarwa ita ce itatuwa da hakukuwa suke shaka tana yi musu amfani . Su kuma wadda su ke fitarwa

mara amfani agare su , ita mu da dabbobi mu ke shaka , tana yi mana amfani .

لقد بحث كبار العلماء حتي أجابوا علي هذا السؤال فقالوا :

إنه بيننا نحن الآدميين وبين النباتات والأشجار نو ع عجيب من التبادل النفعي ، فالهواء الفاسد الـــذي نخرج به " هواء الزفير الملئ بثاني أكسيد الكربون " لتستنشقه النباتات والحشائش جميعها فتستفيد منه . وما تخرج به هى الأخري " الأكسجين " نستنشقه نحن والدواب فنستفيد به .

وفي هذا دعوة كريمة للحفاظ علي الأشجار والنباتات وعدم الزحف والجور علي الأشـــجار التي هى صلب جمال الطبيعة ، والتي هي أيضاً بمثابة المصفي أو المرشح الذي يستخدم في تنفيه الهواء من الملوثات .

ولا غريب أن نجد الرسول (ص) نادي بهذا منذ أكثر من ألف وأربعمائة وعشرين عاماً حيث يقول :

" ما من مسلم يغرس غرساً أو يزرع زرعاً فيأكل منه الطير أو إنسان أو بهيمة إلاّ وكان له به صدقه "
– رواه مسلم .

وفي هذا يقول المولي عز وجل :

" ولا تفسدوا في الأرض بعد إصلاحها وادعوه خوفاً وطمعاً ، إن رحمت الله قريبٌ مـــن المحســـنين "
الأعراف – ٥٦ .

إن الموارد الطبيعية التي يعتمد عليها الإنسان في حياته ، ليس من الغرابة أن يوليها اهتماماً كبيراً ، لأنها السند القويم له في الحياة ، وبدونها سوف ينتهي إلي طريق مجهول .
ولا غرابة أن نجد كاتباً هوساوياً قد تحدث تفصيلياً عن العديد من الموارد ، مفصلاً في جانب كبير منها ومدققاً فيه علي الرغم من أنه أديب في المقام الأول والأخير .

فقد تحدث عن الأرض موطن الكائنات ، وتحدث عن الماء وسرد بعضاً من الحكايات التي تشير إلي أهمية الماء بالنسبة للكائنات ، وتحدث أيضاً عن الهواء ، ثم الإنسان باعتباره الفاعل الأول في البيئة وأهم مورد علي الأرض ، وتحدث كذلك عن الحيوان والنبات والزواحف والحشرات . وتحدث أيضاً عن ضرورة الحفاظ علي الأشجار والنباتات التي هي روح البيئة على الإطلاق .

ومن خلال قراءة هذا المؤلف الذي اعتمدنا عليه في مادة البحث – وجدنا أنه يضم بين صفحاته الكثير والكثير من الكائنات على مختلف أشكالها إلا أننا اقتصرنا هنا على ما ذكرناه في متن البحث مع معالجة متواضعة من طرفنا – الباحث – تمثلت فى شرح وتبيان بعض المفاهيم من جانب و الاستشهاد ببعض آيات القران الكريم والحديث النبوي من جانب آخر للوقوف على تأكيد القول ، و ذلك من أجل أن يحقق البحث ولو قدراً من هدفه المعمول لأجله .

والله من وراء القصد

هوامش البحث

١- ابن منظور -- لسان العرب – ج٦ – ص ٤٨١٠ .

٢- ابن منظور -- لسان العرب – ج٦ – ص ٢٦٣٤ .

٣- رشيد الحمد ، محمد سعيد صبّاريني – البيئة ومشكلاتها ، عالم المعرفة – الكويت – أكتوبر سنة ١٩٧٩م . ص ١٢ .

٤- ابن منظور -- لسان العرب – ج١ – ص ٦١-٦٢ .

٥- المرجع السابق – ج٦ – ص٤٣٠٢ .

٦- صبري سلامة – الماء ودلالته في اللغات الإفريقية (الهوسا – السواحيلية – الأمهرية) مجلد ندوة المياه – معهد البحوث والدراسات الإفريقية – جامعة القاهرة سنة ١٩٩٨م .

٧- دينيس ف . أوين – البيئة وقضاياها – ترجمة د . أحمد مستجير – مركز النشر لجامعة القاهرة سنة ١٩٩١م – ص ١٤٤ .

٨- صبري سلامه – الماء ودلالته في اللغات الإفريقية – مرجع سابق .

9- AL-haji Abu bakar Imam – Ruwan Bagaja – NNPC - Zaria . Nigeria 1971 .

10- Ibrahim Yaro Yahaya – Tatsuniyoyi Da Wasanni – 4 - Zaria – Nigeria –1976 .

١١- ابن منظور – لسان العرب – ج٣ – ص ١٧٦٣ .

١٢- ابن منظور – ج١ – ص ١٤٧-١٤٨ .

١٣- ابن منظور ج٢ – ص ١٠٧٧ .

١٤- ابن منظور ج٦ – ص ٤٣١٧ .

١٥- المنجد – الطبعة الكاثوليكية – بيروت – ص ٣٠١ .

١٦- ابن منظور – ج٢ – ص ٨٨٣ .

مصادر البحث

Abu bakar Imam – Ikon Allah – Zaria – Nigeria – 1986 – part: 1-2-3-4-5 .

القرآن الكريم .

العمارة الخضراء فى افريقيا

أ ٠ د عادل يس محرم

أستاذ العمارة – بجامعة – عين شمس

تتميز العمارة الخضراء بأنها دعوة الى الحافظ على البيئة كما هى فى الاصل الحـافظ على الانسان فى جوانب صحته و مجتمعه و عمارته . ولقد عاصرت العمارة الحديثة منذ بـداياتها مراحل فكرية و تنفيذية كانت تأخذ فى حسالها الشكل و الوظيفة اعمارة و الحكام و الصفوة ، و عليها نجد الصروح الخاصة من القلاع المتنوعة ، و القصور التى امر بها الحكام و الجماعـات المميزة اقليما اما مساكن العامة فيوجد منها ما يعلن أنها لم تكن الا مأوى لهم . ثم جاء وقـت تجسدت فية فلسفات– يمكن ارجاعها لفلسفات ذات بعد واحد فى اغلب ارتبطت اكثـر مـا ارتبطت بفلاسفة معماريين فرادى أمثال ميز و لوكوربوزينة و فرانك لوبـد رايـت و غيرهـم ، ظهرات على اثرها تتعامل مع الاقتصاد اومع العضوية او مع الافراد ، او الفلاسفة سياسين أمثال لينين و هتلر ، ظهر على اثرها العمارة الاشتراكية فى العمارة السوفيتية، و العمارة النازيـه و كلها الت الى زوال.ظهر بعد ذلك فى مصر فيلسوف القرن الماضى حسن فتحى ودعوتـه الى عمارة الفقراء ليبصرنا بأهمية الربط بين البيئة و العمارة وتلك فترة انطلقت فيهـا مفصـلة التاريخ–كما أسماها استاذنا الجليل د.القصاص– بما تعبئة من فكر متكامل نحو البيئة .

تكامل الفكر البيئ أن ترتبط مكونات أى اتجاه علمى ارتباطا متزنا يكون فية الحافظ على الحيز الارضى نظيفا لليوم وللغد .متوافقا مع المتطلبات ومع الامكانيات ، حافظا و مراعيا للموارد و المكونات ، محتفظا بمكونات مخلوقات الله فى تعددها وتنوعها . وهنـا نعـود لميـزات العمارة والخضراء فنذكر أنها هى التعامل بايجابية بيئية مع الطاقة.وثانها – ادخال خصائص العناصر المناخية فى حسابات التصميم والتنفيذ المعمارى لتوفير الحيز المكانى الانسانى للقاطيين. و الثالثـة هى التعامل مع المتطلبات الانسانية كل حسب احتياجاته فىمبناه . و الرابعـة تتطلـب المعرفـة القصوى بخواص مواد البناء و بما يخدم العمارة . أما الميزة الخامسة فلها خصـائص وشموليـه و قيادة تلك الفرقة الرباعية و المنسق قيما بينها بحيث تأتى متوافقة داخليا و خارجيا .

وباعتبار أن الحفلظ عل الطاقة هو اول اهتمامات ذلك الاتجاه، حفاظا على ذلك المورد و حفاظا على ما يسببة من اضرار نحو استخدامه فى أوجه التنمية الحضارية . و فى هـذا الصـدد اتجهت عدة دول حتى الان نحو ترشيد التصميم المعمارى – اضافة لموضوعات أخرى– جملـة و تفصيلا بهدف تقليل استهلاك الطاقة من جانب و الاستفادة من قوى الطبيعة و التعامل معها بصورة أكثر توافقا او كما قالها شيخ المعماريين حسن فتحى العمارة المتوافقة.فان استخدامات ضوء النهار و نستشعرات الضوء فى ضبط كمية الاضاءة اللازمة الداخلية فى المبانى تؤدى الى تقليل استهلاك

الطاقة .كما أن استخدام ألواح الخلايا الضوئية فوق الاسطح بهدف انتاج الكهرباء المطلوبة قد يساعد فى استكمال الطلب عليها .اما فى مجال التصميم المعمارى – مبانى المكاتب مثلا – اذا استخدمت فكرة الحيز المفتوح–بدلا من أحيزة المكاتب المقفلة– يمكن تقايل حوالى ٤٥% على مسطح الحوائط غير اللازمة،و٦١% توفيرا فى عدد الابواب ،و٣٩% تقليلا فى طاقـة الاضـاءة،وزيادة ٦٥%فى مسطح العمل. هكذا يمكن – من الناحية التصميمية– التعامل مع الطاقة و بالتالى التعامل مع البيئة .

تسعى الامم –و نحن معها– نحو التقليل من المنصرف من الطاقة المصنعة و المسـتخدمة فى التنمية اللازمة بكل أوجهها ، و فى نفس الوقت نسعى – و يجب ان نسعى–نحو التقليل من الطاقـة الطبيعية التى نستقبلها من الشمس ، على المناطق الحضرية ، حتى نصل الى الاتزان المناسـب للحياة المناسبة لنا. فتلك الطاقة الشمسية تصب من طاقتها على الارض ما يصل الى حوالى ٤٧٠ وات على المتر المربع فى اليوم .ولموضوعنا–افريقيا (شكل رقم ١)– تتعرض القارة الى كم ضخم من الطاقة الشمسية الساقطة عليها ، تميزت به مناطقها و ظهرت فى عمارتها. و فى مصر – كنمـوذج– نرى ان سماء العاصمة مفتوحة طول اليوم و معظم أيام السنه، فلا شك أنها تستقبل كما هائلا من تلك الطاقةكل يوم ،على مبانيها و على شوارعها ،وتظل محتفظة بها اذا استمر الليـل المتعاقـب ساخنا .وهذا ما نشعر به عادة ايام الصيف .

تشغل شوارع العاصمة (شكل رقم ٢) مسطحا قيمنه حوالى ٣٠% من مساحتها.وباضافة مسطح الطرق العلوية التى أنشئت حديثا قد يصل المسطح الكلى الى حوالى ٣٥% اى ما يساوى تقريبا ثلث العاصمة اى =١٣٣ كيلو متر مربع ، بعد ان هذا اذا اعتبرنا أن مسطح القاهرة الحالى قد يصل الى حوالى ٤٠٠ كيلو متر مربع، بعد اضافة الامتدادات العمرانية شمالا و شرقا و غربـا . ونحمد الله بأن الشوارع كلها مكسوة بالاسفلت الجيد الخالى من الحفر و التكسيرات ، حتى نحافظ على الثروة القومية من السيارات التى تجرى عليها . ولكن لو نظرا الى تلك الثروة من زاوية اخرى نجد ان الطاقة التى يستوعبها الاسفلت من اشعة الشمس الساقطة علية تعنى التالى :

يحتفظ الاسفلت الاسود بحوالى ٩٠% من الطاقة الساقطة علية أثناء النهار ليردها مرة اخرى الى هواء القاهرة .وباطلالة على مجال "التكلفة و العائد "، نجد أن ما قد تستوعبة العاصمة من الطاقـة الشمسية يصل الى الاتى:

١٣٣ × ١٠٠٠×١٠٠٠ × ٤٧٠ = ٦٢،٥١٠ مليون وات فى اليوم .

هذا الكم الهائل من الطاقة الساقطة يوميا على القاهرة – فى أيام الصيف خاصة –يكلف المجتمع القاهرة ما يقابله ماديا من الناحية التقنية و من الناحية الطبيعية القدر الكبير . و قد يترك–

كما يحدث حاليا ما يؤثر على وضائف الاعضاء الجسيمة و يصيبها بالكسل و بالتالى بالكساد الوظيفى و المادى للدولة.

اثنين و ستون مليون كيلو وات فى اليوم تشكل عبئا ضخما اتمنى ان نستمكن من التعامل معه من خلال الجوانب المعمارية و العمرانية ، و من جوانب تنسيق المواقع ، ومن الجوانب التقنية فى تصنيع الاسفلت . واذا تم التفكير فى التعامل مع تلك المعطيات للتقليل من الطاقة الساقطة نسطيع أن نقلد دولا أخرى فى اسلوبها – فهو نهج الولايات المتحدة الامريكية فى هذا الطريق ، وهو اسلوب تقتصد فية من المنصرف من الطاقة القومية ما يصل الى حوالى ٢٦مليون دولار سنويا ، فهى تصبغ اللون الفاتح على واجهات المبانى و تزيد من الاشجار التى تكسو أكبر مسطح من الاسفلت لكى بعكس الطاقة أكثر من استيعابها.
ولننظر الان الى وضع الطاقة فى افريقيا .حتى تكتمل فكرة البيئة المعمارية؟

وضع الطاقة فى افريقيا

تعاظمت المقادير المنصرفة من الطاقة فى السبعة عشر عاما المتتالية من ١٩٨٠ و حتى ١٩٩٦ فى القارة (شكل رقم ٣)بصورة تدعو الى النظر بشمولية فكرية ، فالمحصول الكلى للطاقة الابتدائية – بدون المحروقات المتجددة--ارتفع من ٨٦و١٣٣ مليون طن مكافئ الى٥٣و٢٢٥ مليون طن مكافئ. ووارادت الفحم الصلد – المستخدم لاغراض الطاقة – تضاعف حوالى خمس مرات ،وتصديرة تضاعف مرتين ،ذلك فى حين ان انتاج الكهرباء المائية لم يتحرك رقمها —، و انتاج الكهرباء من باطن الارض و من الشمس و من الرياح وغيرها تركز فى دولتين فقط هما اثيوبيا و كينيا وقد ازداد فى نفس المدة من ١٥ جيجاوات ساعة الى. ٤٥٨ جيجاوات ساعة.

المجال الحيوى فى افريقيا

الارض الافريقية عبارة عن مسطح من الصخور القديمة ،تشغلل خمس مسطح اليابس على الكرة الارضية ،وتنقسم الى قسمين متساوين تقريبابواسطةخط الاستواء.أما مساحتها فهى ٧٠٠، ٣٦٥، ٣٠ كيلو متر مربع. سواحلها ضيقة يحدها الجبال ،تختفى وراءاها منخفضات تتسع عند موزمبيق وعند موريتانيا و عند القطارة شمال مصر وعند مناديرعلى القرن الافريقى . أرض القارة ترتفع فى المتوسط الى ٦٧٠ متر عن سطح البحر، و لكن ارتفاعها يتراوح ما بين ٥٨٩٥ متر عند كليمانجار فى تنزانيا ، الى ١٥٧ متر تحت سطح البحر عند بحيرة أسال فى جيبوتى هذه الارض تحدها من الشرق سلسلة جبال أطلس فى الشمال الى أعلى من ٤٠٠٠ متر أما من الجنوب فتقع صحراء ناميت و كالاهاى اللموارد المائى الاساسى للقارة يتمثل فى مياة الامطار التى تسقط على الوسط ،

تكون عدة انهار أهمها النيل الى الشمال ، و نهر النيجير الى الغرب ، زامبيزى الى الجنوب . اما الخزانات المائية فهى بحيرة فيكتوريا ،وبحيرة تنجانيقا و بحيرة نياسا ، وبحيرة تشاد اوكافانجو.

مناخ القارة يتلخص فى الحرارة العالية فى معظم أيام السنة ، و لكنها تتبسط بواسطة الارتفاعات فى الجبال ومن تأثير المحيط مثل تيار بنجويلا البارد – فى الجنوب الغربى – ، وتيار موزمبيق – الجنوب الشرقى . كما وان وجود الغابات الذى يشغل سدس القارة ، يساعد على استقرار المناخ .

تنعم القارة بتنويعات كثيرة من الحيوانات ، وهو ما يعطيها ذلك الثراء المعروف عنها فى مجال التنوع البيولوجى . ومن احسن الحدائق الوطنية فى العالم هى الموجودة فى كينيا وتنزانيا وجنوب افريقيا .

فى القارة توجد ثروات تعدينية هامة ، فهى تحوى ٨% من بترول العالم، ٢٧% من البوكسيت ، و٢٩% من كل اليورانيوم فى العالم ، و٢٠% من النحاس، وفى القارة أيضا ثلثى الفسفور وكميات كثيرة من الحديد الخام والمنجنيز والكروميوم والكوبالت و البلاتينيوم والتيتانيوم.

المجال الثقافى فى افريقيا :

يعتقد أن الجنس البشرى نشأ فى افريقيا منذ حوالى ٢٥ مليون الى ١٥ مليون سنه ، وتطور عن الاشكال القديمة **Hominids** الذى يرجع فى تاريخة الى ثمانية ملايين من السنين أما الأشكال الأحداث من **Homo erectus , homo habilis** فقد سكن اجزاء كثيرة من افريقيا فى فترة ما قبل العصر البلايستوسينى . وظهر فيها الهومو سابين **homo sapien** من نحو ٥٠٠,٠٠٠ سنة ، واخيرا ظهر الإنسان الحديث منذ نهاية العصر البلايستوسينى .

يتكلم السكان الأفريقيون لغات عدة قد تكون الأكثر من أى قارة اخرى . فهى اساسا بين العربية فى الشمال " والبانتو" فى الوسط وفى الجنوب ، المابا فى تشاد ، والكوما فى منطقة النيل الأزرق و السونجاى فى النيجر وتلك التنويعات اللغوية صاحبها تنويعات ثقافية واردة ، حيث تأثرت القارة بعدة هجمات ثقافية ، بدأت فى العصر القديم ، بالفينيقيين الذين استمروا لمدة حوالى ستمائة سنة فى الشمال الغربى من القارة ، ثم الرومان ، ثم العرب بعد دخول الاسلام الى القارة على القرن السابع الميلادى ، أما ثقافة ما يختص بتجارة " العبى" فقد نمت بجوار تجارة الذهب وثمار الكولا فى غرب افريقيا حيث بلغ عدد الرقيق المأخوذ منها الى نحو عشرة ملايين انسان وفى العصر الحديث كان البرتغاليون هم الوائل الذين هجموا على افريقيا فى القرن الخامس عشر ، ثم الهولنديون فى منتصف القرن السابع

عشر ، ومنذ ذلك الحين استوطن الفرنسيون فى الشمال والهولنديون فى الجنوب ، والبريطـــانيون فى زامبيا واعالى افريقيا افريقيا الشرقية والبرتغاليون فى انجولا وموزمبيق ، والألمان فى ناميبيا ومنذ ١٩٥٠ بدأت الحركات الاستقلالية فى القارة ، وبدأت الحريات لشعوبها تأخذ مجراها .

يلعب الدين دورا أساسيا في حياة كل الشعوب الأفريقية ، وعند البعض ـــ مثل ال فالي في الكاميرون ، أو ال نانكأني في بوركينا فاسو يضفي الأهل علي كل أجزاء البيت الرموز الروحية المميزة ومن أكثر النماذج التي تمت دراستها في هذا الصدد كانت عند أل دوجون الذين عاشوا على الحافــة الصخرية لل باندياجارا في مالي هناك تمثل البيت في صورة رجل ممدد على جانبه حيث قلب البيت يمثل الرأس والمخازن تمثل الأيدي والإسطبلات تمثل الأرجل والغرفة الرئيسية تمثل البطن وحجر الطاحونة للأعضاء التناسلية ، ذلك التمثيل الإنساني ينسحب علي عمارقم من البيت الواحد وحتي القرية ككل كل عنصر لة ارتباط رمزي ، وديني أما عن المباني التذكارية فلا وجود لها حيث لا توجد في عقائدهم ما يدعو له إذ تسكن الأرواح في الشجر وفي الأشكال المنحوتة أو في معابد صغيرة بسيطة ، وهنــاك مبني هام في تلك الثقافات هو بيت مباري الخاص ب أوبري إيجبو في نيجيريا وهــو مكــان مفتــوح الجوانب مسقطه مربع يحتوي علي منحوتات إنسانية في الحجم الطبيعي ، ملونة ، من الطين ، وترمز إلي ألهه الأرض ألا وبجواها منحوتات أخري ولأن عملية البناء عملية مقدسة فإن بيوت مباري تبني علــي مدد طويلة ، ثم تترك لتتحلل ، لكي تنشأ أخري غيرها جديدة •

المدن الإفريقية

تدار المدن الإفريقية حاليا ـــ وإحداها مدينة مراكش التقليديــة (شــكل ٤) بأفنيتــها و شوارعها المتفاعلة مع الظروف المناخية ـــ تدار تحت ظروف غاية في الصعوبة ، حيث ينمــو عــدد السكان بسرعات عالية أما اقتصاديات الدول الغنية مثل نيجيريا فهي تقع تحت ضغوط هائلــة، مــع اتزان سلبي بين زيادة المدفوعات وزيادة الديون وحيث لا تقدم الدولة الخدمات ، تقع الألتزمات على السكان في الحضر هذا مع حقيقة أن معدل النمو الحضري فاق الإمكانيات الإدارية والمصادر التمويلية وأهم ما يوجه من نقد في هذا الموضوع هو أن البيئة الفيزيقية تعاني من إساءة استخدام شامل وغياب التخطيط علي المدي الطويل •

يمكن أن يعزي موضوع الإساءة إلي الحضر في سياسة الحكومة إلي كارثة الحضر اليوم في المدن الإفريقية ولكن هذا لا يعني أن المدن يجب أن تهمل لأن ذلك سيضخم من المشاكل الوطنية وعلي ذلك فإن السياسات المتواصلة مطلوبة كحل فوري وحيث أن التفاصيل تتغير من دولة إلي أخري ففي كل المدن الكبرى يوجد ما هو الدافع القوي لإيجاد الحلول المتوافقة محليا بعضا من تلك الحلول تتمثــل في القرارات علي المستوي الوطني مثل نقل العاصمة بعض أخر من القرارات تشمل إعادة تشكيل البلدية

مثل اللامركزية في دكار وإبيدجان كما أن معظم الحكومات قد أعفت نشاطاقا من توفير الخـــدمات المجانية للفقراء والطبقات المتوسطة تاركة للأفراد والمجتمعات مواجهة احتياجاقم من خـــلال تنفيـــذ المشروعات مثل توصيل مياه الشرب ، ومنازل المجهودات الذاتية ، وحفر الآبار الخاصة ، ومولـــدات الكهرباء المترلية الخاصة ولكن مثل تلك الحلول يمكن ممارستها فقط بواسطة المترفين نسبيا ، كمـــا أن بعضا منها لا يلقي الاهتمام العام وعلي ذلك فإن متاعب المدن الكبري في أفريقيا تمثلـــت في نمـــوذج يتضح من اعتبار نيروبي مدينة في مهرجان بعد أن كانت مدينة في الشمس مثل ما كتـــب في جريـــدة الإسكان هو أخر الخدمات التي تتضمن عناصر هامة لنوعية الحياة في

وعلي هذا فإن احتياجات العمارة الخضراء لم تكن إلي ذلك الوقت معروفة على الأطلاق وفي مجال نقاطها الخمس ، بل كانت نقاط أخري قمتم بالتقنيات الحديثة في الإنشاء وبالمواد الرخيصـــة في الثمن وبالمساكن المناسبة ٠

ختام

تحتاج المجتمعات الإفريقية إلي مراعاة الاحتياجات البيئية في مناطقها المتنوعـــة ، وفي مجـــال العمارة تتمثل الطاقة في أها العامل الأهم في ترتيب الألتزمات الواجب التعامل معها أو انطلاقا من مبدأ الحفاظ علي البيئة المحلية والعالمية كان الهدف هو التقليل ما امكن من الطاقة المنصرفة وتقليلا من الطاقة الشمسية الساقطة على تلك العمارة وما يحيطها درء لما يمكن أن تسببه من رفع لـــدرجات الحـــرارة المحيطة بها تكاملا مع الاحتياجات الأخرى من التعامل مع المناخ واحتياجات الجمهور ومواد البناء في سبيل إنتاج بيئة معمارية أكثر تكاملا وتوافقا مع البيئة ٠

ماذا بعد القضاء نهائيا على مرض الطاعون البقرى من أفريقيا؟

د. سمير محمد حافظ

مستشار منظمة الأغذية والزراعة

ذلقد كان الطاعون البقرى أخطر مرض حيواني تسبب في نفوق مئات الملايين من الحيوانات الأفريقي خلال القرن الماضي. وكانت مكافحة هذا المرض تعتبر الشغل الشاغل للإدارات البيطرية في أغلب الدول الأفريقية. وبالإضافة إلى ذلك، فقد نفذت منظمة الأغذية والزراعة عدة حملات إقليميه متعاقبة لمكافحة هذا المرض على مستوى القارة الأفريقية. وبالرغم من نجاح هذه الحملات في السيطرة مؤقتا على المرض، إلا أنها كانت لا تقضي على المرض نهائيا مما يؤدى إلى معاودة ظهوره بصورة وبائية بعد عدة سنوات من انتهاء كل حمله. لذلك تطورت خطط المنظمة لتتمشى مع الإستراتيجيات الخاصة بمكافحة الأمراض الوبائية عن طريق استئصالها من العالم و التي نجحت منظمة الصحة العالمية في تنفيذها فعلا والقضاء نهائيا على مرض جدري الإنسان منذ أكثر من ربع قرن. وبناء على ذلك، بدأت المنظمة منذ عام ١٩٩٥ في تنفيذ برنامج للتخلص عالميا من مرض الطاعون البقرى (Giobal Rinderpest Eradication program) قبل عام ٢٠١٠بإذن الله. ويتم تنفيذ هذا البرنامج من خلال تنظيم متزامن لثلاث حملات إقليميه لتغطية مناطق العالم الموبوءة هذا المرض، إحداها لإقليم جنوب شرق آسيا والأخرى لإقليم غرب آسيا و الثالثة على مستوى قارة أفريقيا (Pan African Rinderpest Campaign). وحتى يتم تقييم فعالية هذه الحملات والتأكد من القضاء نهائيا على أي جيوب محتمله للمرض في الدول المستفيدة، فيجب على كل دوله أن تلتزم بتنفيذ برنامج محلى محكم على ثلاث مراحل. وتبدأ المرحلة الأولى بمكافحة المرض بواسطة التحصين الجماعي لكل الأبقار والجاموس وتقييم فعالية المناعة الناتجة عن التحصين بواسطة تطبيق طرق مصليه متطورة- وبعد مرور عامين من مواصلة هذا التحصين دون أن تظهر أي حالات مرضيه، يصبح من الممكن الإعلان رسميا بأن الدولة أصبحت خاليه مؤقتا من المرض. ثم تبدأ المرحلة الثانية بإيقاف التحصين مع مواصلة الاختبارات المصلية للتأكد من عدم وجود أجسام مناعية ضد الفيروس المسبب للمرض في مصل الحيوانات التي ولدت حديثا ومرت فتره كافيه لفقدان المناعة التي اكتسبتها من أمهاتها- مما يدل على عدم تعرضها لإصابة محتملة بذلك الفيروس والمفترض أنه قد أصبح غير موجودا في البيئة. وبعد انقضاء ثلاث سنوات أخرى دون أن تدل الاختبارات المصلية عن أي احتمال للعدوى، يتم الإعلان أن الدولة أصبحت خاليه من المرض. ثم تبدأ المرحلة الثالثة، وبعد انقضاء عامين إضافيين مع مواصلة الاختبارات السابقة دون الكشف عن أجسام مناعية في مصل الحيوانات التي لم يسبق تحصينها يتم الإعلان النهائي بأن بيئة الدولة خاليه فعلا من الفيروس المسبب للمرض. وقد وصلت كثير من الدول الأفريقية- ومن ضمنها مصر- إلى المرحلة الثالثة من هذا البرنامج ومن المتوقع أن تنجح كل الدول الأفريقية فى القضاء نهائيا على المرض بإذن الله قبل الميعاد المحدد فى عام ٢٥١٠. و بالتالى، سيصبح من

الممكن للإدارات البيطرية الأفريقية استثمار طاقاتها– التى كانت موجهة أساسا للقضاء على الطاعون البقرى– لمكافحة أمراض حيوانية أخرى.

ونظرا لأن إستراتيجية هذا البرنامج تعتمد أساسا على التعاون الدولى والتنسيق الإقليمى بين الدول المشاركة فى إطار خطه علميه وعمليه متكاملة يتم تقييم فعاليتها فى كل مرحله مــع تــدريب العاملين والتوفير المجانى للإمكانيات اللازمة، فسوف يتم استعراض أهم الدروس المتوقع اكتسابها مــن خلال هذه التجربة الرائدة حتى يمكن الإستفاده منها مستقبلا للارتقاء بخدمات الصــحة الحيوانيــة بالدول الأفريقية كوسيلة لتنمية الثروة الحيوانية على مستوى القارة.

مقــــــدمة

بالرغم من أن أفريقيا لديها حوالى١٥ ٥/٥ من الثروة الحيوانية فى العالم، إلا أن إجمالي إنتاجية هذه الحيوانات يعتبر قليلا جدا إذا قورن بإنتاجية مثيلاتها فى القارات الأخرى التى لديها تعداد أقل من الحيوانات. وتعتبر أمراض الحيوان الوبائية المستوطنة فى بعض مناطق القارة من أهم العوامل التى تعوق التنمية الأفقية و الرأسية للثروة الحيوانية فى أغلب الدول الأفريقية. وقد كان مرض الطاعون البقرى من أهم الأمراض التى سببت خسائر فادحه لاقتصاديات الإنتاج الحيوانى فى أفريقيا– وكانت مكافحة هذا المرض هى الشغل الشاغل للإدارات البيطرية فى أغلب الدول الأفريقية على مدى عدة عقود من القرن الماضى. ونظرا لطبيعة المرض بالنسبة لسهولة عبوره للحدود السياسية بين الــدول المتجــاورة (**Transboundary Disease**)، فقد كان من الضروري تنظيم حملات إقليميه بواسطة منظمة الأغذية و الزراعة الدولية وبتمويل من جهات متعددة لمكافحة المرض على مستوى أفريقيا. ولكــن لم يكن مخططا لهذه الحملات أن تستأصل المرض تماما، وبالتالى كانت تؤدى إلى السيطرة على منع انتشاره عن طريق تحصين أكبر عدد ممكن من الحيوانات القابلة للإصابة. ونظرا لتوقف التحصين بعد انتــهاء الحملات مع استمرار وجود جيوب متبقية للمرض، فقد كان المرض يعاود ظهوره على هيئة أوبئة مرة أخرى. و التالى، فقد غيرت منظمة الأغذية و الزراعة إستراتيجياتها لتتحول من حمــلات للاحتــواء المؤقت للمرض فى أقاليم معينه من العالم إلى برنامج متكامل لاستئصال المرض نهائيا من العالم قبل عــام ٢٠١٥ بإذن الله– وذلك أسوة بالبرنامج الناجح الذى سبق أن نفذته منظمة الصحة العالمية لاستئصال مرض جدرى الإنسان منذ حوالى ربع قرن.

وسوف يتم فى هذه الدراسة استعراض تاريخ انتقال مرض الطاعون البقرى مــن آســيا إلى أفريقيا و انتشاره فى أغلب مناطق القارة وتسلسل برامج مكافحته إلى أن وصلت إلى المرحلة الحالية فى إطار البرنامج الخاص باستئصال المرض من أفريقيا (**Pan African Rinderpest (PARC**

Campaign) كجزء مـــن البرنـــامج العـــالمي للقضـــاء علـــى المـــرض مـــن العـــالم أجمـــع (Global Rinderpest Eradication Program (GREP).

نبذة تاريخية عن تأثير مرضى الطاعون البقرى على البدء فى إنشاء مهنة الطب البيطرى فى العالم

كان أول وصف لمرض مشابه للطاعون البقرى فى القرن الرابع الميلادى بـــبعض البلـــدان الأسيوية ثم تكرر الوصف فى القرن التاسع الميلادى بعد أن انتقل المرض إلى أوروبا نتيجة للحمـــلات العسكرية المتبادلة بين آسيا وأوروبا حينذاك. ويبدو أن المرض قد أصاب أغلب الدول الأوروبيـــة فى ذلك الوقت. وظل المرض يعاود الظهور فى أوروبا على فترات متعاقبة. وفى القرن الثامن عشر حدث وباء خطر أكتسح معظم الدول الأوروبية وأدى إلى نفوق أكثر من ٢٠٠ مليون بقره. ونظرا لعـــم تواجد مهنة الطب البيطرى آنذاك، فقد كان يتم تدارس الملاحظات حول المرض بواســـطة الأطبـــاء البشريين ومربى الحيوانات. لذلك فقد كان من الضروري العمل على إيجاد متخصصـــين فى أمـــراض الحيوان يمكنهم تحديد مسببات المرض وطرق مكافحته والوقاية منه والعمل على احتوائه. و بالتالى، تم إنشاء أول مدرسه بيطرية فى عام ١٧٦٢ فى ليون بفرنسا وأعقبها إنشاء مدرسه بيطرية أخرى فى عام ١٧٧٨ فى هانوفر بألمانيا ثم توالى إنشاء مدارس ومعاهد وكليات بيطرية فى عديد من الدول الأوروبية. وبالتدريج بدأت الدول الأوروبية فى إنشاء إدارات بيطرية هدف مكافحة مرض الطاعون البقرى. و يتضح مما سبق أن انتشار مرض الطاعون البقرى فى أوروبا كان هو الحافز الأساسى الـــذى أدى إلى إنشاء مهنة الطب البيطرى بوضعها الحديث فى العالم. ونظرا لاستمرار وجود المرض، فقد كان مـــن الضروري إيجاد برامج موحدة لمكافحته ف الأقاليم التى يظهر فيها. و بالتالى تم عقد أول مؤتمر بيطرى عالمى فى هامبورج بألمانيا فى عام ١٨٦٣ هدف مناقشة أفضل الطرق للقضاء على المرض من أوروبـــا ومنع انتشاره فى مناطق أخرى من العالم. وفعلا نجحت أوروبا فى القضاء على المرض قبل معرفة مسببه الفيروسي و اكتشاف اللقاحات التى تحمى من الإصابة به وذلك بتطبيق لوائح الحجر البيطري وإعدام الحيوانات المصابة مع الحيوانات المخالطة لها. إلا أن المرض انتقل إلى أوروبا مرة أخرى فى عام ١٩٢٥ عن طريق شحنة أبقار هندية تم تفريغها ف ميناء أنتفرين ببلجيكا لنقلها إلى باخرة أخرى متجهـــة إلى البرازيل حيث ظهر المرض لأول مره فى أمريكا الجنوبية بعد وصول هذه الشحنة.

وأدى هذا الحادث إلى تحليل الأخطار المحتملة من نقل حيوانات من بلدان موبوءة بالمرض إلى مناطق أخرى من العالم – و بالتالي تقرر إنشاء المكتب الدولى لأوبئة الحيوان فى عام ١٩٢٧ ببـــاريس هدف وضع لوائح تمنع انتقال الأمراض الحيوانية عن طريق استراد الحيوانات الحية ومنتجاها المختلفة.

أول حدوث للمرض بأفريقيا فى منطقة القرن الإفريقى فى عام ١٨٩٠ نتيجة لانتقاله عن طريق الحملات العسكرية المتنقلة بين أوروبا والهند و التى كانت تتوقف فى بعض الموانى الأفريقية. ثم بدأ المرض ينتشر فى جميع الاتجاهات حتى وصل إلى مصر شمالا وإلى دول أفريقيا المطلة على المحيط الأطلنطى غربا وإلى رأس الرجاء الصالح جنوب وأدى إلى نفوق عشرات الملايين من الأبقار. ونظرا لأن الخسائر التى سببها المرض كانت تحد من طموحات المستعمر الأوروبي آنذاك، فقد أنشأت بريطانيا مركزين لدراسة ومكافحة أمراض الحيوان الوبائية– أحدهما فى موجوجو بكينيا لشرق أفريقيا والآخر فى فوم بنيجريا لغرب أفريقيا. كما أنشأت كلا من فرنسا وألمانيا مراكز مماثلة فى كل من تشاد و ناميبيا، على التوالى. وتركز النشاط الإيطالي فى القرن الإفريقي. ونتيجة للمراسلات التى أجريت فى هذه المراكز تم تحديد وعزل المسبب الفيروسى للمرض والتوصل إلى طرق بدائية لتشخيصه بواسطة حقن الأبقار القابلة للإصابة ثم محاولة استضعاف الفيروسي لانتاج لقاحات بدائية بعد تمريره فى فى الماعز أو بقتل الفيروس بواسطة الفورمالين. ثم تطور استضعاف الفيروس بتمريره فى الأرانب وأجنة بيض الدجاج. ثم توصل العالم الإنجليزى بلورايت الذى كان يعمل فى مركز الأبحاث البيطرى بكينيا فى عام ١٩٥٧ إلى إنتاج اللقاح الآمن والفعال الذى يتم استخدامه حتى الآن بعد تمرير الفيروسي فى الزرع النسيجي. كما تم اكتشاف طرق إقتصادية للكشف عن الأجسام المناعية المتكونة نتيجة للتحصين باستعمال الزرع النسيجي. وبذلك توفرت للدول الأفريقية الوسائل العلمية لمكافحة المرض عن طريق التحصين إلى جانب تقييم كفاءة التحصين بين الحيوانات التى تم تحصينها. و بالتالي، بدأت كثر من الدول الأفريقية فى تطبيق برامج قطريه لمكافحة المرض– كان بعضها يعتمد على التحصين فقط والبعض الآخر يعتمد أيضا على تقييم كفاءة التحصين مع إجراء دراسات تقصى عن بؤر المرض. ونظرا للتباين بين البرامج المطبقة بواسطة الدول المختلفة، فقد استمر تعاود ظهور المرض فى كثير من الدول الأفريقية. لذلك بدأ المكتب الأفريقي لأوبئة الحيوان (**Inter-African for Epizootic Diseases**) التابع لدول الكومونويلث بالاشتراك مع منظمة الوحدة الأفريقية ومنظمة الأغذية والزراعة الدولية والإدارات البيطرية لبعض الدول الأفريقية فى عام ١٩٦٢ فى تنفيذ أول حمله أفريقية لمكافحة الطاعون البقرى فى غرب أفريقيا. وعرفت هذه الحملة تحت اسم "المشروع المشترك–١٥ " (**Joint Project-15(JP-15)**). وتم خلال هذه الفترة تحصين ٨١ مليون حيوان مما أدى إلى التوقف المعنوى للخسائر الناتجة عن المرض ولكن لم يتم القضاء عليه نهائيا. وفى عام ١٩٦٨ امتدت الحملة إلى شرق أفريقيا واستمرت حتى عام ١٩٧٦ وتم تحصين ما يزيد عن ١٧٠ مليون حيوان. وبالرغم من تنفيذ هذه الحملات الإقليمية إلى جانب البرامج التى تنفذها كل دولة على حده وبعضها مدعم بواسطة منظمة الأغذية والزراعة (مثل مشروع المنظمة الذى تم تنفيذه فى مصر من عام ١٩٦٢ إلى عام ١٩٦٨ لإنتاج لقاح الطاعون البقرى في الزرع النسيجي)، إلا أن المرض عاود الظهور بصوره وبائية فى بداية عقد الثمانينات فى عديد من البلدان الأفريقية ومن ضمنها مصر. ومرة

أخرى، قررت منظمة الأغذية والزراعة وبتمويل من الاتحاد الأوروبي تنظيم ثلاث حملات لمكافحة المرض فى المناطق الموبوءة فى العالم- إحداها فى أفريقية والثانية لمنطقة غرب آسيا والثالثة لمنطقة جنوب شرق آسيا. وانتهت هذه الحملات فى أوائل عقد التسعينات وأدت إلى سيطرة معنوية على المرض فى أغلب الدول التي شاركت في هذه الحملات الثلاث. ولكن نظرا لاستمرار وجود جيوب للمرض في بعض البلاد وللخوف من معاودة ظهوره بصوره وبائية مرة أخرى، فقد كونت منظمة الأغذية والزراعة بالاشتراك مع المكتب المولى لأوبئة الحيوان في باريس **Office International des Epizooties (OIE))** وجميع الخبراء المتخصصين في هذا المرض مجموعة عمل لمناقشة كيفية القضاء نهائيا على هذا المرض من العالم أجمع خلال فتره زمنية محددة. وتم التوصل إلى البرنامج الذي ينفذ حاليا منذ عام ١٩٩٥ من خلال حملتين في آسيا وحملة في أفريقيا والذي يستهدف القضاء على المرض فائيا من العالم قبل عام ٢٠١٠ إنشاء الله.

مراحل القضاء على المرضى في الدول الموبوءة في إطار البرنامج العالم لاستئصاله

حتى يتم التأكد من التخلص فائيا من المرض في الدول الموبوءة حاليا وكذلك عمم انتقاله إلى الدول المجاورة لها والمعرضة لخطر الإصابة، فقد توصلت مجموعة العمل المسئولة عن التخطيط للقضاء على المرض من العمالم مع خبراء المكتب الدولي لأوبئة الحيوان في باريس إلى مسار يعرف "بمسار المكتب الدولي لأوبئة الحيوان في باريس إلى مسار يعرف " بمسار المكتب الدولي لأوبئة الحيوان " —) **OIE**

(**Pathway** وذلك للتخلص نهائيا من المرض يتم تنفيذه بواسطة كل دوله موبوءة أومعرضه لخطر الإصابة على ثلاث مراحل متعاقبة:

المرحلة الأولى:

(١) تبدأ كل دوله في تنفيذ برنامج دقيق لمراقبة المرض وتسجيل كل حاله يتم الاشتباه فيها كمرض مشابه للطاعون البقرى وتجميع عينات منها للتشخيص المعملي لإثبات أو نفى أن المرض المشتبه فيه حالة طاعون بقرى. وفى حالة ثبوت أن المرضى طاعون بقرى، فيجب إرسال الفيروس المعزول إلى المختبر المرجعي العالمي للمرض في بريطانيا لإجراء دراسات على البصمة الوراثية للفيروس ومقارنته بالفيروسات السابق عزلها من نفس الدولة ومن الدول المجاورة أو من أي منطقه من العالم في أوقات مختلفة لتتبع المصدر المحتمل للإصابة وتحديد عما إذا كان أصلها محلى (في حالة تطابق الفيروس وراثيا مع الفيروسات السابق عزلها من نفس المنطقة)- أو تكون الإصابة ناتجة عن طريق انتقال أو استيراد حيوانات من مناطق أخرى لو كان الفيروس المعزول مختلفا وراثيا عن الفيروسات السابق عزلها من نفس المنطقة وفى نفس الوقت متشابها مع فيروسات

معزولة من مناطق أخرى) وذلك تطبيقـا لمسـتحدثات علـم الوبائيـات الجزيئيـة (Molecular Epidemiology).

(٢) وفى نفس الوقت يجب تحصين جميع الحيوانات القابلة للإصابة باستعمال لقاح محضر في الزرع النسيجي تم تأكيد اختبار سلامته وفعاليته في مختبر متخصص- وكذلك تم تخزينه ونقله تحت درجات حرارة منخفضة منذ إنتاجه حتى استعماله.

(٣) يجب تقييم فعالية التحصين عن طريق الرقابة المصلية (Seromonitoring) بتطبيق اختبارات الارتباط الأنزيمي للامتصـاص المنـاعي (الإليـزا-ELISA) بواسـطة الإختصاصيين المحليين الذين تم تدريبهم من خلال البرنامج المشترك بين منظمة الأغذية والزراعة والهيئة الدولية للطاقة الذريـة في فيينـا (International Atomic Energy Agency (IAEA) و الذي يورد للدول المشـاركة المجموعـات التشخيصية (Kits) والخاصة بإجراء اختبار الإليزا بدون مقابل. كما يجب التأكد من معنوية الاختبارات التي تجرى محليا بالنسبة لتكوين أجسام مناعيـة ضـد الفـيروس المستخدم في إنتاج اللقاح باستعمال الضوابط كل مره وتقييم النتائج طبقـا لبرنـامج الحاسب الآلي المرفق مع المجموعات التشخيصية.

(٤) وبالإضافة إلى ذلك، يجب تطبيق لوائح الحجر البيطري لمنع تنقل الحيوانات مـن وإلى المناطق الموبوءة وكذلك منع دخول مصادر جديده محتمله للإصابة من خارج القطر.

(٥) وفى حالة تطبيق الخطوات المذكورة أعلاه بطريقه صحيحه، فانه من المتوقع أن تقـل حالات الإصابة إلى أن يتم القضاء عليها. وبعد مرور عامين كاملين (٢٤ شهر) على تسجيل آخر حاله إكلينيكية لمرض الطاعون البقرى، فإنه يمكن أن يتم اعتبار البلد "خالية مؤقتا من مرض الطاعون البقـرى" (Provisionally Free from Rinderpest). وبالتالي، تستطيع السلطات البيطرية المحلية إبلاغ المسئول الفني على تنفيذ الحملة الإقليمية والمكتب الدولي لأوبئة الحيوان في باريس عن ذلك الوضع وتفاصيل نتائج الاختبارات التي أدت إليه.

(٦) في حالة الإعلان رسميا عن خلو البلد مؤقتا من المرض- يتم إيقاف استعمال اللقـاح نهائيا ويبدأ العمل في المرحلة الثانية.

المرحلة الثانية:

(١) يجب على السلطات البيطرية في البلد الذي تم الإعلان عن خلوه مؤقتا مـن مـرض الطاعون البقرى مواصلة الرقابة الإكلينيكية كما هو مذكور في البنـد الأول مـن المرحلة الأولى.

(٢) يجب مواصلة الرقابة المصلية لاختبار عينات مصل مجموعه من حيوانات ولدت بعـد إيقاف التحصين ومر عليها فتره كافيه لتفقد المناعة التي اكتسبتها من أمهاتها للتأكـد

من عدم تكوين أجسام مناعية ضد فيروس الطاعون البقرى كنتيجة محتمله لإصابة طبيعية بالفيروس لو كان موجودا في بيئة الحيوان(**Serosurveillance**). أي أن هذه الحيوانات التي أصبحت قابله للإصابة تستخدم في هذه المرحلة ككشاف (**Indicator**) لاحتمال وجود فيروس الطاعون البقرى في البيئة التي يعيش فيها الحيوان.

(٣)يتم تطبيق لوائح الحجر البيطري كما هو مذكور في البند الرابع من المرحلة الأولى.

(٤)في حالة مرور ثلاث أعوام (٣٦ شهر) منذ إعلان أن البلد أصبح خاليا مؤقتا من المرض ودلت نتائج الرقابة الإكلينيكية عن عدم ظهور أي حالات جديدة للمرض وفى نفس الوقت تدل نتائج فحوص الرقابة السيرولوجية الوبائية عن عدم الكشف على أجسام مناعية ضد فيروس الطاعون البقرى في أمصال الحيوانات التي ولدت في هذه المرحلة ولم يتم تحصينها بعد أن تفقد المناعة المكتسبة من أمهاتها- فيمكن للسلطات البيطرية إبلاغ المسئول عن الحملة بأن البلد أصبح خاليا من المرض (**Free from Rinderpest**).

(٥)في حالة الإعلان رسميا عن خلو البلد من المرض- يتحول إلى تنفيذ المرحلة الثالثة من مسار المكتب الدولي لأوبئة الحيوان للقضاء فائيا على الطاعون البقرى.

المرحلة الثالثة:

(١) يتم مواصلة مراقبة المرض كما هو مذكور في البند الأول من المرحلة الأولى.

(٢) يتم مواصلة الرقابة المصلية الوبائية (**Serosurveillance**) كما هو مذكور في البند الثاني من المرحلة الثانية للتأكد من عدم تكوين أجسام مناعية ضد فيروس الطاعون البقرى في أمصال الحيوانات التي لم يسبق تحصينها وليس لديها مناعة مكتسبة من أمهاتها- مما يدل على عدم وجود فيروس الطاعون البقرى في البيئة التي يعيش فيها الحيوان.

(٣) يتم تطبيق لوائح الحجر البيطري كما هو مذكور في البند الرابع من المرحلة الأولى.

(٤) في حالة مرور عامين بعد إعلان أن البلد أصبح خاليا من المرض دون ظهور أي حالة إكلينيكية للمرض وبدون الكشف على أجسام مناعية ضد فيروس الطاعون البقرى في أمصال الحيوانات التي لم يتم تحصينها وليس لديها مناعة مكتسبة من أمهاتها- يمكن للسلطات البيطرية الإبلاغ بأن البلد أصبح خاليا من الفيروس المسبب للمرض (**Free from Infection with RinderpestbVirus**).

(٥) بعد الإعلان رسميا عن خلو البلد من الفيروس المسبب للمرض- يتم اعتبار أنه تخلص تماما من مرض الطاعون البقرى ولا توجد أي جيوب محتمله للمرض. وفى هذه الحالة، يجب على السلطات البيطرية إعدام كل فيروسات الطاعون البقرى المتواجدة في

المختبرات المحلية التي كانت تعمل على هذا المرض.

ومن الجدير بالذكر، فقد شاركت كل الدول الأفريقية التي كانت موبوءة بالمرض خلال أواخر عقد الثمانينات من القرن الماضي في الحملة الأفريقية لاستئصال مرض الطاعون البقري من العالم. ونجح كثير من هذه الدول- ومن ضمنها مصر- في التوصل إلى المرحلة الثالثة من المسار المذكور أعلاه. و توجد حاليا، جيوب محدودة للمرض في جنوب السودان و أوغندا و كينيا و الصومال و إثيوبيا و إريتريا، و ربما في تنزانيا أيضا.

التنظيمات الإدارية و الفنية للبرنامج العالمي لاستئصال مرض الطاعون البقرى على المستويات العالمية و الإقليمية و القطرية

يعتمد نجاح البرنامج للتوصل نحو تحقيق أهدافه على دقة تنظيم العمل وتوزيع المسئوليات بعد تدريب الفنيين المنفذين مع متابعة و تقييم مدى كفاءة كل خطوة. و يتم ذلك من خلال ثلاث مستويات من الأجهزة الإدارية:

الإدارة المركزية:

تتكون من خبراء قسم خدمات صحة الحيوان بمنظمة الأغذية والزراعة الدولية في روما والمكتب الدولي لأوبئة الحيوان في باريس وقسم صحة الحيوان في الهيئة العالمية للطاقة الذرية في فيينا المسئول عن إمداد المجموعات التشخيصية الخاصة بإجراء اختبارات الإليزا للتقييم المصلى أو التقييم المصلى الوبائي مع تدريب الفنيين الذين يقومون هذه الاختبارات في الدول المشاركة. وتتعاون هذه الإدارة المركزية مع المسئولين عن المختبر المرجعي للمرض في بريطانيا ومع بعض الخبراء المختارين على مستوى العالم والذين لديهم باع طويل في إجراء دراسات رائدة في هذا المجال. وتشمل الواجبات الرئيسية للإدارة المركزية النقاط التالية:

(١) التنسيق بين الحملات الثلاث للبرنامج (حملتان في آسيا وحملة في أفريقيا).
(٢) توفير التمويل اللازم لهذه الحملات وإمدادها بمتطلبات العمل.
(٣) متابعة النتائج التي يتوصل إليها البرنامج عن طريق تحليل التقارير التي تعدها كلا من الإدارات الإقليمية والقطرية- مع تطوير برامج العمل لو كان ذلك ضروريا.
(٤) عقد اجتماعات دوريه للقيادات العاملة في البرنامج.
(٥) تنفيذ برامج تكميلية لدعم هذا البرنامج مثل: " نظام الطوارى للوقاية من الأمراض والآفات الحيوانية العابرة للحدود"(**Emergency preventive system (for Transboundary Animal Diseases (EMPRES) and Pests** – و الشبكة الإقليمية للمعلومات عن مراقبة ومكافحة أمراض

الحيوان Regional Animal Disease Surveillance and Control (Network) (RADISCON).

(٦)وضع برامج للطوارئ (Contingency plans) يمكن إتباعها مباشرة للسيطرة على المرض في حالة حدوثه المفاجئ- وكذلك يمكن الاسترشاد بها بواسطة كل دوله لتضع خطة طوارئ خاصة بها.

(٧)دعم المعامل البيطرية المرجعية العالمية لتمكينها من الفحص المجاني للعينات الخاصة بتنفيذ البرنامج و التي ترسلها الدول المشاركة. وكذلك إنشاء مختبرات إقليميه لتأكيد كفاءة سلامة وفعالية اللقاحات المنتجة محليا مثل معمل PANVAC الذي أقامته منظمة الأغذية والزراعة في أثيوبيا لتقييم كفاءة اللقاحات المنتجة في أفريقيا و إقليم الشرق الأدنى.

(٨)إتاحة مواقع محدده على شبكة الإنترنت لبث البيانات المتجددة عن الأوضاع الوبائية للمرض على مستوى العالم ولتشجيع المسئولين البيطريين في الدول المختلفة على تبادل المعلومات والحوار فيما بينهم وبين الخبراء العالميين لحل أي مشاكل طارئة.

الإدارات الإقليمية:

توجد لكل حمله من حملات البرنامج الثلاث إدارة منفصلة مسئولة عن تنفيذ النقاط التالية:

(١)التنسيق بين الدول المشاركة في الإقليم.

(٢)توفير متطلبات تنفيذ البرنامج في كل دوله (لقاحات- وسائل مواصلات- معدات للتحصين وتبريد اللقاح أثناء تخزينه ونقله-- معدات لإجراء اختبار الإليزا شاملة لحاسب آلي مبرمج لتقييم كفاءة الاختبارات- الخ).

(٣)تنظيم دورات تدريبيه إقليميه متخصصة لكل العاملين في الحقل والعاملين في المختبرات في كل الدول المشاركة.

(٤)عقد اجتماعات دورية متخصصة للمسئولين الوطنيين على تنفيذ البرنامج في دول الإقليم المشاركة – على أن يتم تقديم تقرير من كل دوله (Country Report) عن تقدم العمل الخاص بموضوع و هدف الاجتماع.

(٥)تقييم كفاءة العمل بالنسبة لتنفيذ البرنامج في كل دوله طبقا للمراحل الخاصة بمسار المكتب الدولي لأوبئة الحيوان(OIE-Pathway) لإعلان مراحل خلو كل بلد من المرض حتى تصبح خاليه تماما من الفيروس المسبب للمرض.

(٦)تحليل التقارير الوطنية المقدمة من الدول المشاركة بالإقليم وإعداد تقارير إقليميه لتوزيعها على دول الإقليم وتبادلها مع الإدارات الإقليمية الأخرى ورفعها مع نسخ من التقارير الوطنية إلى الإدارة المركزية.

حتى يتم التأكد من جدية تنفيذ البرنامج في كل دوله من الدول المشاركة فقد كان من الضروري أن تلتزم كل دولة بأن تكلف بعض الفنيين لديها بالتفرغ لإدارة الحملة القطرية لمكافحة المرضى محليا وألا يكون هذا العمل الهام عملا شرفيا أو جانبيا للقيادات الإدارية إلى جانب أعمالهم الأخرى. وبالتالي، فإن على كل دولة من الدول المشاركة تنفيذ النقاط التالية قبل البدء في مشاركتها:

(١) تعيين منسق وطني للبرنامج يصبح مسئولا عن الإشراف على تنفيذ الحملة الوطنية وعن الاتصال بالإدارة الإقليمية للبرنامج.

(٢) تكوين لجنة وطنية متخصصة لوضع اللوائح الوطنية اللازمة لتنفيذ البرنامج وكذلك خطط الطوارى المحلية التي يمكن تنفيذها فورا في حالة الظهور المفاجئ للمرض- على أن تكون هذه اللوائح وخطط الطوارى متمشية مع الإستراتيجية المركزية للبرنامج و تتواءم في نفس الوقت مع الظروف المحلية.

(٣) تحديد أحد المختبرات المحلية ليصبح مختبرا وطنيا للطاعون البقرى- و يتم تدريب العاملين فيه على إجراء اختبارات الرقابة المصلية و اختبارات الرقابة المصلية الوبائية باستعمال طريقة الإليزا. ويتم دعمه بالأجهزة والمعدات اللازمة. ويستحسن أن تكون لدى هذا المختبر إمكانيات لعزل الفيروس في الزرع النسيجي.

(٤) تكوين مركز وطني لمكافحة أمراض الحيوان تتبعه مراكز فرعية في المحافظات لو كان ذلك ضروريا. ويشرف علي هذا المركز فنيون تم تدريبهم من خلال الدورات التدريبية على النواحي الوبائية والإحصائية التي يتم تنظيمها بواسطة الإدارة الإقليمية- ويكون هذا المركز مدعما بوسائل الاتصال مع جميع مناطق الدولة والمراكز الفرعية و تكون لديه كافة الإمكانيات اللازمة لتنفيذ البرنامج ولتدعيم المراكز الفرعية. وفى نفس الوقت يكون مسئولا عن تجميع البيانات الوبائية عن المرض وسير العمل بالنسبة لبرامج التحصين أو الرقابة المصلية في جميع المناطق وتحليل هذه البيانات والنتائج أولا بأول وإعداد تقارير دورية. وبناء على هذه التحليلات والاستنتاجات المنبثقة عنها، يمكن اتخاذ القرارات الخاصة بتحول البلد من مرحلة إلى مرحلة بالنسبة لمكافحة المرض طبقا للمسار الموضوع بواسطة المكتب الدولي لأوبئة الحيوان. و بالتالي يصبح من الضروري توعية الرأي العام عن هذه الأوضاع المستجدة عن طريق وسائل الإعلام المختلفة.

وحرصا من منظمة الأغذية والزراعة على دقة التزام الإدارات المحلية للدول المشاركة فى البرنامج على تنفيذ كل الخطوات المخطط لها و التى تؤدى إلى التخلص نهائيا من المرض فى هذه الدول، فقد نشرت عدة كتب عن تفاصيل تنفيذ البرنامج وطرق الرقابة على المرض وإعداد خطط الطوارئ وطرق الإنذار المبكر وإدارة أزمات صحة الحيوان وغر ذلك من تفاصيل تؤدى

إلى الارتقاء بكفاءة الخدمات البيطرية المحلية في الدول المشاركة. وإلى جانب ذلك، فإن المنظمة لديها فريق كامل من الخبراء والمستشارين يمكنهم التوجه إلى أي دوله تطلب المساعدة من المنظمة لمعاونتها على حل أي مشكله طارئة.

الدروس التي قد تستفيدها الإدارات البيطرية الأفريقية من آليات العمل أثناء تنفيذ البرنامج

مما لاشك فيه أن دقة التخطيط لتنفيذ البرنامج بواسطة خبراء عالميين متخصصين في كافة المجالات التي يدور حولها القضاء النهائي على المرض، قد أدت إلى تغطية كافة العوامل التي تساعد على التوصل إلى أفضل كفاءه للتنفيذ- وكذلك العمل على سد كل الثغرات المحتملة التي قد تحدث نتيجة لعدم خبرة أو تهاون الأشخاص المسئولين على تنفيذ البرنامج في الدول المشاركة و التي قد تكون خدماتها البيطرية ليست على المستوى المطلوب. وبالتالي، بان تحليل وتقييم آليات البرنامج و الاستنتاجات و النتائج المنبثقة عنه بواسطة الإدارات البيطرية في الدول الأفريقية- حتى في الدول التي كانت خاليه من الطاعون البقرى و لم تشارك في البرنامج- سوف يكون مفيدا جدا للاستفادة من هذه الآليات و الاستنتاجات بالنسبة للارتقاء بالخدمات البيطرية في هذه الدول و احتمال إعادة هيكلتها بطريقة قد تضاعف من حسن أدائها، إلى جانب مكافحة المزيد من أمراض الحيوان المستوطنة في أفريقيا. وقد تكون النقاط التالية أمثلة لبعض الدروس التي يمكن استيعابها من البرنامج الذي يتم تنفيذه حاليا لاستئصال مرض الطاعون البقرى من أفريقيا:

(١) الاسترشاد بالتخطيط المتكامل و ضرورة توفير كافة المتطلبات اللازمة لتنفيذ البرنامج حتى يصبح من الممكن فعلا التوصل إلى الغرض المستهدف و ذلك بالنسبة للتخطيط لتنفيذ مشاريع مستقبلية لمكافحة مزيد من أمراض الحيوان المستوطنة في أفريقيا.

(٢) ضرورة الإبقاء على الخبرات التي اكتسبها الفنيون العاملون في الهياكل الإدارية و الفنية التي تكونت أثناء تنفيذ البرنامج والذين تم تدريبهم من خلال الدورات الإقليمية التي نظمها البرنامج وذلك لتنفيذ مشاريع مستقبلية مماثلة.

(٣) أهمية الاستفادة من الخبرات التي اكتسبها العاملون في مختبر الرقابة المصلية بتطبيق اختبار الإليزا و تقييم نتائجه بواسطة الحاسب الآلي لتوحيد معنوية الاختبارات التي تجرى في دول مختلفة وذلك لإجراء اختبارات مستقبلية للتقصى عن وبائية أمراض حيوانية أخرى.

(٤) تقييم أهمية التنسيق الإقليمي مع الدول المجاورة بالنسبة لتنفيذ برامج مستقبلية لمكافحة أمراض الحيوان العابرة للحدود بفعالية أفضل وبتكاليف أقل.

(٥) تقييم أهمية الاستفادة من إمكانيات المنظمات الدولية و الإقليمية ذات العلاقة بالنسبة لمكافحة أمراض الحيوان في أفريقيا- مع تحديد أساليب التعامل الفني والسياسي مع هذه المنظمات للتوصل إلى آلية فعالة لإعداد مشاريع مستقبلية يتم قبول تنفيذها وإيجاد

مصادر لتمويلها بواسطة هذه المنظمات.

(٦) تقييم أهمية الاستفادة من الإمكانيات التي تتيحها المختبرات البيطرية المرجعية العالمية لمرض معين أو لعدة أمراض ومن الخبرات المتواجدة في هذه المختبرات خصوصا بالنسبة لتطبيقات علم الوبائيات الجزيئية.

(٧) تقييم أهمية إنشاء مختبرات وطنية بيطرية مرجعية لبعض الدول الأفريقية والتطلع لتحويلها مستقبلا إلى مختبرات أفريقية مرجعية لمرض حيواني معين أو لعدة أمراض.

(٨) تقييم أهمية تأكيد جودة (**Quality Assurance**) اللقاحات البيطرية التي يتم إنتاجها محليا بالدول الأفريقية في مختبر أفريقي إقليمي معترف به دوليا ويتم العمل به تحت إشراف منظمة الأغذية والزراعة.

(٩) تقييم أهمية إجراء التقصي و الرقابة على أمراض الحيوان– سواء كانت رقابة إكلينيكية للكشف عن حالات المرض أو رقابة مصلية للتأكد من فعالية برامج التحصين المطبقة في الحقلي أو رقابة مصلية وبائية للتأكد من عمم وجود بؤر محتملـه للإصـابة في أي منطقه تم اعتبارها خالية من المرض– و ذلك أثناء تطبيق برامج مستقبلية لمكافحة المزيد من أمراض الحيوان المستوطنة في أفريقيا.

(١٠) تقييم أهمية التزام كل الدول المشاركة في البرنامج بالنسبة للمرور بطريقه موحـدة خلال المراحل الثلاث من مسار المكتب الدولي لأوبئة الحيوان قبل أن يتم الإعلان عن خلوها تماما من الفيروس المسبب للمرض، و ذلك للتأكد قطعيا من عـدم احتمـال وجود جيوب متخفية للمرض.

تقييم أهمية إعداد خطط طوارئ لمواجهة التعامل مع المكافحة الفورية لأي مرض حيواني وبائي قد يظهر فجأة– وإدارة تلك الأزمة الناتجة بطريقة علمية سليمة ومدعمـة مسـبقا مـن السلطات السياسية– وذلك حتى تتم مكافحة المرض في أقصر وقت و بأقل خسائر.

وقد تكون النقاط المذكورة أعلاه أمثلة فقط لبعض الدروس التي يمكن الاستفادة منـها نتيجـة لتطبيق هذا البرنامج الرائد الذي سوف يؤدى بإذن الله إلى التخلص النهائي لأول مرض حيواني من العالم. وقد تؤدى الملاحظات المنبثقة عن الفنيين المحليين المسئولين عن تنفيذ البرنامج في كل دولة إلى تسجيل نقاط هامة ذات طابع معنوي يمكن الاستفادة منها عالميا. لذلك يجب تسجيل مثـل هـذه الملاحظات بكل دقة في التقارير القطرية الدورية عن تقدم العمل المحلى في كل دولة.

بالرغم من أهمية تخلص أفريقيا نهائيا من مرض الطاعون البقرى الذي تسبب في حدوث خسائر اقتصادية فادحه لأغلب دول القارة طوال القرن الماضي، إلا أن النجاح المتوقع في القضاء على هذا المرض بإذن الله سوف يمثل أبعادا إضافية هامة لبرامج التنمية في أفريقيا. وقد تكون النقاط التالية بعض الأمثلة لهذه الأبعاد المتوقعة:

(١) سوف يحفز القضاء على الطاعون البقرى الإدارات البيطرية للدول الأفريقية على مواصلة التنسيق فيما بينها لتنفيذ برامج مماثلة للقضاء على المزيد من أمراض الحيوان المستوطنة فى القارة. وربما تتبنى منظمة الوحدة الأفريقية هذا التنسيق الذي قد ينبثق عنه إنشاء منتدى أفريقي للصحة الحيوانية (**Animal Health Forum for Africa**) مما سوف يساعد على تكوين جمعيات علمية أفريقية في المجالات المختلفة للصحة الحيوانية و نشر مجلات علمية دورية و عقد ندوات و مؤتمرات في هذه المجالات.

(٢) ستؤدى المكافحة التدريجية لأمراض الحيوان في أفريقيا إلى التنمية الأفقية والرأسية للثروة الحيوانية الأفريقية من ناحية وإزالة بعض العوائق الأساسية التي كانت تحول دون تصدير الفائض من هذه الحيوانات أو منتجاتها إلى الأسواق العالمية من ناحية أخرى. و بالتالي، سيؤدى تصدير هذا الفائض إلى تحسين المستوى الاقتصادي للدول المصدرة و تمكينها من تنفيذ برامج طموحه للتنمية مما سوف يرفع مستوى معيشة المواطنين في كثر من الدول الأفريقية.

(٣) إن هذه الأوضاع الجديدة قد تؤدى إلى الاستفادة من آليات القمة الأفريقية – الأوروبية التي عقدت لأول مرة بالقاهرة في مارس ٢٠٠٠ لتنفيذ مشاريع شراكه بين أوروبا وأفريقيا في مجالات الصحة والإنتاج الحيواني – مما سوف يساعد على نقل الخبرات والتكنولوجيا الأوروبية إلى أفريقيا وتطوير الخدمات البيطرية الأفريقية والارتقاء بها .

(٤) إن إزالة العوائق الصحية التي كانت تعوق دون تصدير الحيوانات الأفريقية إلى الأسواق العالمية قد يجعل من أفريقيا سوقاً بديلة لأوروبا بعد أن أصبحت الحيوانات واللحوم الأوروبية بضاعة غير قابلة للتصدير ، نظراً لانتشار مرض جنون البقر في كثير من الدول الأوروبية .

وبالإضافة إلى النقاط العامة المذكورة أعلاه ، فمن المتوقع أن تستفيد كل دولة أفريقية من تحويل الأعباء الفنية والمالية التي كانت تبذل لمكافحة مرض الطاعون البقرى إلى مجالات أخرى . ويتضح من ذلك ، أن القضاء النهائي على مرض الطاعون البقرى من أفريقيا ، كجزء من استئصاله من العالم أجمع ، من المتوقع أن يؤدى إلى مزيد من الانطلاق في المكافحة الجدية لأمراض الحيوان في أفريقيا وإلى تنمية حقيقية للثروة الحيوانية ، وبالتالي إلى رفع مستوى معيشة المواطن الأفريقي .

استنباط تصرف فيضان نهر النيل السنوي عند أسوان من معرفة التصرف الأدنى للنيل في نفس السنة وعلاقتهما بالدورات العظمي للشمس

شاهيناز مصطفي على يوسف[١] محمد عز الدين الراعى[٢]

١- قسم الفلك – كلية العلوم – جامعة القاهرة

٢- قسم الدراسات البيئية – جامعة الإسكندرية

المحتويات

في هذه الدراسة تم تحليل بيانات مستويات النهاية الصغرى النهاية العظمي لنهر النيل منذ بداية الهجرة حتى عام ٨٧١ هجرية (٦٢٢ – ١٤٦٧ ميلادية).

حيث تم فصل مساهمة المنطقتين الاستوائية **Equatorial** والاثيوبية **Ethiopia** وتم التوصل إلى العلاقات التالية"

Ethiopia = Ethioia – m Equatorial (r=0,8) (1)
and RATTO = a Equatorial – b (r=0,95 (2)

حيث:

RATTO – ETHIOPIAN / EQUATURIAL.

وحيث **a – b** ثوابت:

وقد تم استنباط انه توجد خلال السنوات الحديثة (١٨٧٩ – ١٩٧٣) دورة زمنية موجبة (١١ سنة) في العلاقة بين **RZ** – والمركبة الاستوائية – وأخري سالبة (١١ سنة أيضا) في حالة المركبة الأثيوبية بينما ينعكس الوضع في الفترة (١٨٢٥ – ١٩٠٢).

أما خلال **medieval Maximum** فقد ساد الجفاف في إثيوبيا بينما سادت الأمطار الغزيرة في المنطقة الاستوائية – وقد وجد أن المصادر الاستوائية كانت متوافقة في هذه الفترة مع النشاط الشمسي.

ومن أهم نتائج هذا البحث أن المركبات الأثيوبية المتزعمة والاستوائية (النهاية الصغري) والنسبة بينهما قد تم فصلها إلى ثلاث دورات منفصلة تماما، وقد أظهرت نتائج حلقات الأشجار في شيلي دورات مماثلة تماما حيث استخدمت كامتداد لاستنباط الدورات والتي تم تفسيرها كانعكاس لعدد من العادئات الشمسية الرئيسية، وفي خلال العصر الحديث – استخدمت بيانات البقع الشمسية للحصول على معلومات الدورات الشمسية.

وقد تم عمل قائمة بالدورات الشمسية العظمي خلال الفترة (٧٥٦ – ١٩٠١) وهي:

من نهاية صغري إلى نهاية صغري:

١- (٧٥٦ – ٩٨٦) ميلادية
٢- (٩٧٨ – ١٣١٠ ميلادية.
٣- (١٣٣١-١٤٧٣) ميلادية.
٤- (١٤٧٤- ١٦٩٩)
٥- (١٧٠٠ -١٨١١)
٦- (١٨١٢ – ١٩٠١)

بينما حدثت للدورات العظمي الشمس حديثا وفي عام ١٩٥٩.

والمعادلات المذكورة (١) ، (٢) وجدت سليمة لدورات الشمس والنيل (١، ٢، ٣) وكذلك لتصرف النيل عند أسوان منذ ١٨٧٠.

عندما يحدد النهاية الصغري لتصرف النيل في عام يمكن إيجاد النسبة (ethiopia/ min) باستخدام معادلة تم استنباطها من التصرف عند أسوان في الفترة.

$$\ln ratio\ (1871-1988) = 3.099 - 1.30 \ln Min \qquad (3)$$

(Corr. Coef. = 0.88, Error = 0.23)

وهي معادلة علاقة أبنية عكسية أما التصرف من هضبة الحبشة والنهاية العظمي للتصــرف يمكن حسابها لنفس العام من العلاقة:

$$\text{Total Annual Discharge } (10^6\ m^3) = 4039 + 3.886 \text{ Max Discharge } (10^6\ m^3). \qquad (4)$$

وقد تم حساب الترددات لجميع البيانات – حيــث وجــدت تــرددات ٢٦٥,٥ ، ١٣٢,٩٨٠ ، ٨٨,٦٥، ٦٦,٤٩ سنة -وهي مضاعفات N, 2/N, 3/N, 4/N على التوالي:

وقد أمكن أيضا فصل مركبة الدورة الشمسية (٨٠ عام) – كما أمكن الحصول على دورة قوية ١٩ عاما في السنوات الحديثة وفي مياه الهضبة الاستوائية للدورة، وقد عزيت هذه الــدورة إلى تأثيرات القمر على الاخف الجوي للأرض.

وقد تم عمل قائمة لفترات الجفاف والأمطار الغزيرة في الهضبة الاستوائية والحبشية لأول مرة في الفترة ٦٢٢ – ١٤٦٧ ميلادية ، وهي ذات أهمية هامة في المقارنة مــع ظــاهرة–EI- Nino والذبذبة الجنوبية ENSO.

المقــدمــة

تتوفر البيانات السنوية للنهاية العظ مي والصغري للمستويات نهر النيل منذ بداية الهجــرة (٦٢٢م) وقد نشرت هذه البيانات.(Sami , 1916 Tousson , 1925)

حيث قضي سامي حرالي ٢٥ عاما من عمره لتجميع بيانات تصرف نهر النيل منذ العام الأول للهجرة أي من عام ٦٢٢ إلى عام ١٩١٤م.

وقد أعطيت هذه البيانات بالذراع والأصبع في خلال هذه المقالة وللتحويل إلى المتر أنظر التذييل (١).

نهر النيل

يعتبر نهر النيل من أهم انهار العالم وبين الشكل (١) خريطة سريان النهر من بحيرة فيكتوريا في جنوب القارة الإفريقية حتى البحر المتوسط (انظر awad, 1946) للوصــف التفصــيلي وهنــاك مصدرين لمياه النهر:

أ- المصدر الاستوائي من مياه الأمطار المســتمرة طــوال العــام في المنطقــة الاستوائية.

ب- المصدر الاثيوبي والذي يغذي ن أمطار الصيف.

ويمكن الشكل (٢أ) فيضان نهر حيث يزداد معدل السريان بشدة ثم يضمحل بمعدل أسي.

وتمثل النقط y.x على المنحني بدء ونهاية الأمطار على التوالي:

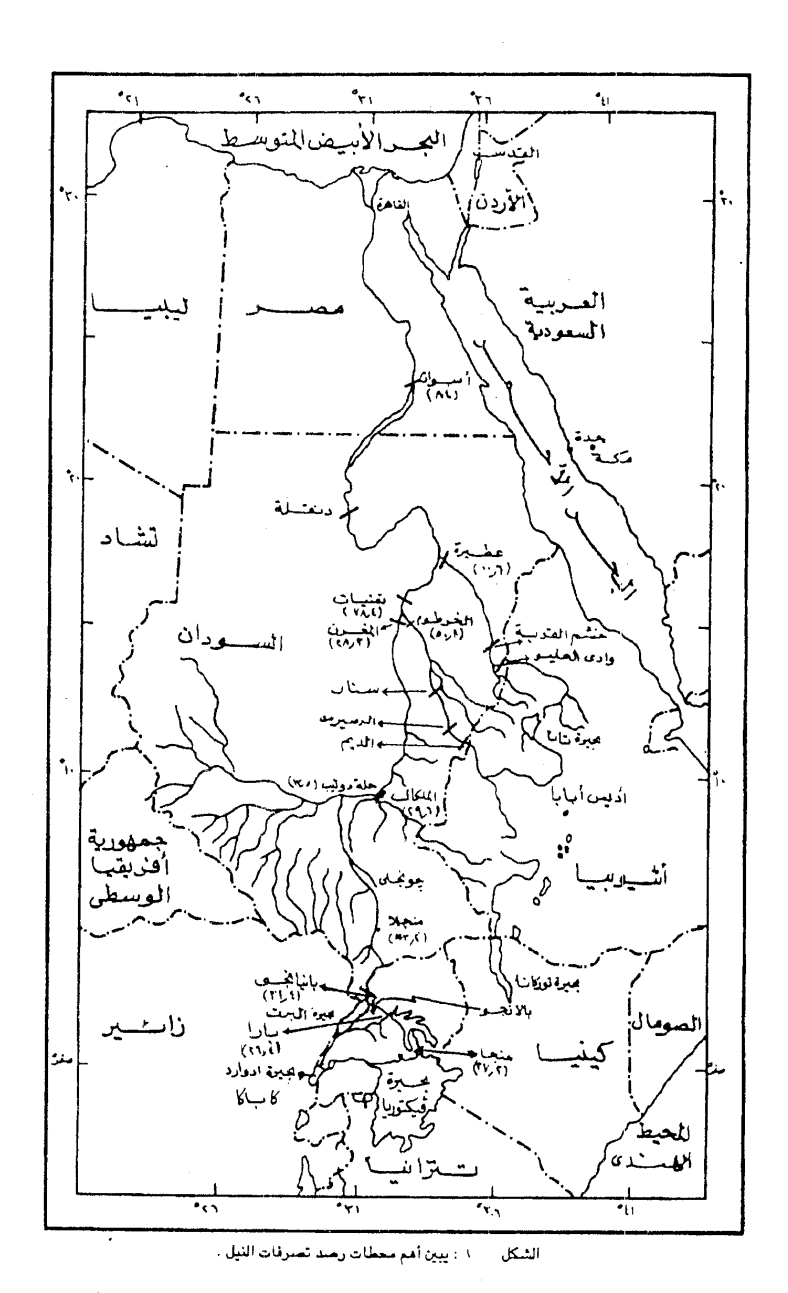
(Hoyt and langbain 1955 cited in ward 1978)

شكل (٢ب) يمثل هيدرورجراف النيل ويبين مساهمة المصدر الاستوائي (النيـــل الأبـــيض) والمصدر الاثيوبي (نهر عطبرة – والنيل الأزرق) ويمثل أقل مستوي على الهيدروجراف (لها) اساســا المساهمة الاستوائية للنيل عند أسوان.

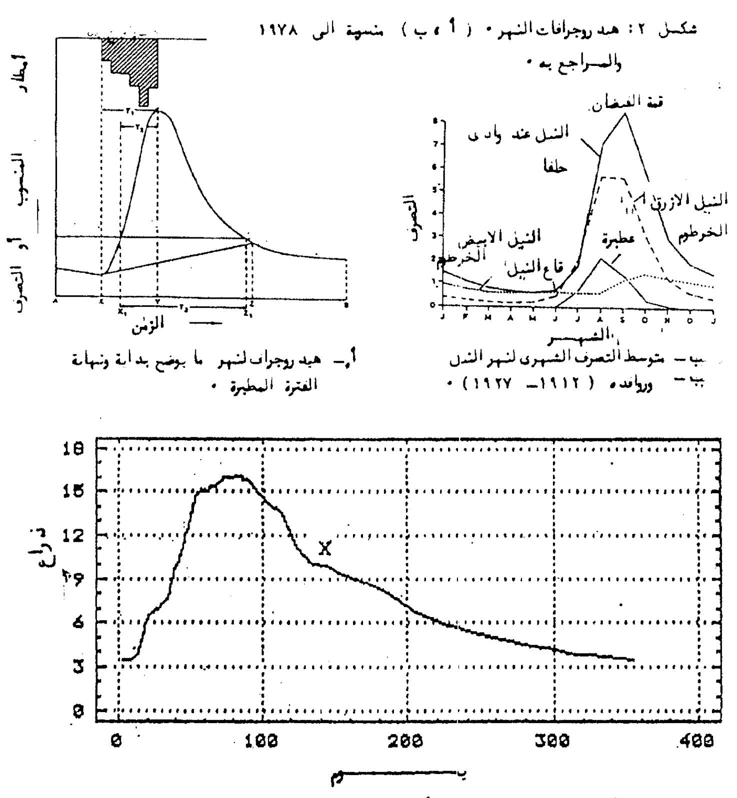
وتمثل مستوي النهاية العظمي عند أسوان (ممثلة **max** في فصل (٢ ب) – مجمـــوع ميـــاه المصدر الاستوائي والاثيوبي.

المياه الاستوائية = **min**.

المياه الاثيوبية =**Max-min**



الشكل ١ : يبين أهم محطات رصد تصرفات النيل .



شكل ٢: هيدروجرافات النهر. (أ ، ب) منسوبة الى ١٩٧٨ والمراجع به.

أ- هيدروجراف لنهر ما يوضح بداية ونهاية الفترة المطيرة.

ب- متوسط التصرف الشهري لنهر النيل وروافده (١٩١٢ – ١٩٢٧).

ج- هيدروجراف منسوب نهر النيل أثناء الحملة الفرنسية. (يوم صفر = ١ يوليو ١٧٩٩) لاحظ الانبعاج عند x بسبب ازدياد تصرف النيل الابيض.

وتهدف هذه الدراسة إلى إجراء تحليل عددي للمتسلسلات الزمنية لتقويم العلاقـــات بـــين المتغيرات المتاهية والأرضية والشمسية.

بالإضافة إلى ذلك – فإنه سوف تقدم نماذج رياضية لمحاولة التنبؤ بالتصرف من المعلومـــات الأولية عن النهاية الصغرى للتصرف لنفس العام.

I– الدراسات الحديثة لمستويات وتصرفات نهر النيل:

هيدروجراف النيل خلال الحملة الفرنسية على مصر:–

خلال الفترة من يوليو ١٧٩٩ حتى إبريل ١٨٠١ ، أخذت بيانات النيل عند مقياس الروضة بواسطة **M,lapere** أحد العلماء الفرنسيين في الحملة وهذه البيانات ذات أهمية حيث أنها أخـــذت يوميـــا خلال ارتفاع وانخفاض الفيضان في مص (١٩١٦ – **sami**) وبين الشكل (٢ ج) هيدروجراف النيل خلال عام ابتداء من ٢ يوليو ١٧٩٩ ، حيث بدأت زيادة المستوي في ٨ يوليو، وصـــلت إلى نهايـــة عظمي في ٢٣ سبتمبر وبدأت في التناقص في اليوم التالي:

وبدأ تكون فترة سقوط الأمطار حوالي ٨٠ يوما – واعوجاج الهيدروجراف عند (١) بسبب مساهمة النيل الأبيض.

تأثير الشمس على تصرف النيل عند أسوان خلال (١٨٧٠ – ١٩٨٢).

حيث أن أحد أهم أهداف هذا البحث هو إيجاد علاقة الشمس بفيضان النيل من البيانـات المتاحـة وحيث أن بيانات البقع الشمسية متاحة فقط حتى القرن الثامن عشر – فإنه رؤي البدء بدراسة العلاقة من تحليل البيانات الحديثة أولا، وقد أخذت بيانات النيل خلال الفترة (١٨٧٠ – ١٩٦٣) ، مـن (hurat et al, 1951, 1968) ومن (Mobarek et al, 1977) ومن مصادر أخري:

وقد تم تعميم البيانات المتاحة مشترك بالإضافة إلى بيانات البقع الشمسية بفلتر متحـرك ٢٦ عامـا والشكل (٣ (أ،ب،ج) بين البيانات المتاحة ويبين الفلتر المتحرك بوضوح أزمنة الزيادة في الـدورات الرئيسية للشمس بينما تحتفظ بالدورات الشمسية ابتداء من الدورات الشمسـية ١٣ (ذات نهايـة عظمي في عام ٦ و ١٨٩٤ إلى الدورة الشمسية ١٩ (ذات النهاية العظمـي عـام ٩, ١٩٥٧) ، (Allen , 1973).

وهناك اتجاه عام إلى الزيادة في مياه المصدر الاستوائي كما تبين بيانات النهاية الصغري للتصرف عند أسوان والتي تتوافق مع الطرف الصاعد – للدورة العظمي للشمس بينما يوجد نقصان عام في النيل في المصدر الاثيوبي – مما يوضح توافق سلبي مع الزيادة في النشاط الشمسي.

ويجب علينا بالتالي التاكيد على وجود دورات عظمي للشمس مع الارتفاع والانحدار مما يؤثر علـى الاتجاه العام لسقوط الأمطار ويؤدي إلى زيادة في الأمطار في منطقة وجفاف في منطقة أخري.

٢– تتوافق بين معامل البقع الشمسية rz ومستوي النيل.

يلاحظ أن دالة التوافق بين Rz وأي من المصدر الاستوائي أو المصدر الاثيوبي تظهر دورات مختلف في الشدة والإشارة من دورة إلى أخري كما يظهر الشكل (٤) على الأخص، يظهر مقيـاس الروضـة (min) سلبيا في الفترة (١٨٢٥ – ١٩٠٢) – بينما يظهر المصدر الاثيوبي هذه الدورة نفسيا يتوافق موجب ولم يظهر أن هناك زمن تأخر في الحالتين.

على الطرف الآخر، في الفترة (١٨٧٠ –١٩٧٣) أظهرت دالة التوافق بين rz والتصرف عند أسوان نقص الدورة بتوافق موجب للمصدر الاثيوبي (شكل ٤ ج.د).

من هذا يظهر أن المصدر الاستوائى يغير توافقه مع معامل البقع الشمسية من سالب في الفترة (١٨٢٥ – ١٩٠٢) إلى موجب في الفترة (١٨٧٠ – ١٩٧٣) وعلى العكس يغير المصدر الاثيوبي توافقه من موجب إلى سالب في خلال نفس الفترة.

وقد ظهرت خلال الفترة (١٨٧٠–١٩٧٣) ظاهرة هامة، حيث ظهر توافق بـين rz في الـدورات الشمسية وتصرف النهر في الدورة التالية وهذا يعني أنه يمكن أخذ البقع الشمسية كمؤثر على مستوي فيضان الدورة التالية.

شكل (٤هــ) يمثل دالة الوافق بين المصدر الاستوائي والمصدر الاثيوبي ويلاحظ أنهما متوافقتين سلبيا وأن بينما يكون معامل التوافق عند زمن ــأخير صفر هو (–٠,٢٥).

بينما يكون معامل التوافق مساويا للصفر عند زمن تأخر +١٠ سنوات – بعدها يصـــبح المصـــدرين متوافقين.

المتغيرات الدورية.

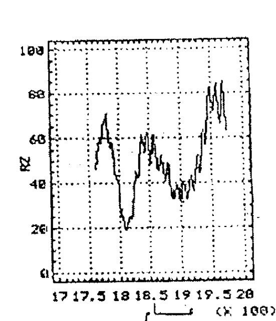
(١) النيل في الفترة ١٧٤٩ –١٨٠٠ الدورات التالية تم التقاطها خلال هذه الفترة في معامـــل البقع الشمسية ومستوي فيضان النيل الشمس: ١٠,٤، ٤,٧٢ – (٢,٤٨) – (٢,٢٦).

النيل نهاية عظمي: ١٣ – ٨,٦٧ – ٥,٧٨ – ٤,٧٢ – ٤,٧٢ – ٣,٠٥ – ٢,٤٨ – ٢,٢٦ – ٢,٠٨. والدورات المشتركة في هذه الفترة القصيرة هـــي ٤,٧٢ – ٢,٤٨ – ٢,٢٦ – وهـــاتين الاخيرتين تعتبران ضعيفتان للشمس.

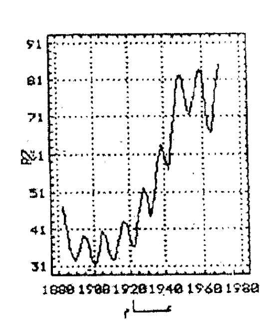
دورات تصرف النيل في الفترة (١٨٧٠ – ١٩٤٥) قام (hurat et al) بجدولة التصرفات النهرية لنهر النيل من سد أسوان خلال الفترة (١٨٧٠ – ١٩٤٥) وقد قمنا باستخراج النهايـــة العظمـــي والصغري الشهرية وحساب الدورات المنهاية العظمي **Max** والنهاية الصغري **min** والفارق المياه الاثيوبية (**min–max**) والنسبة وبيئ الجداول (١) النتائج.

دورات الاحد عشـــر سنة نوق الدورات العظمى للشـــمس

د) ١٧٦٢-١٩٧٤



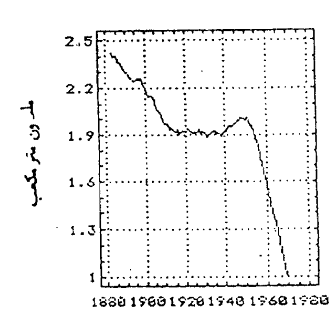
أ) ١٨٨٣ _ ١٩٦٩



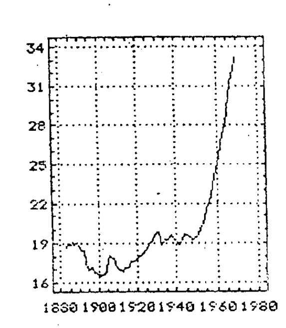


شكل ٣ : تنعيم تصرف النيل عند اسوان(١٨٨٣ _ ١٩٦٩)

ج) التصـــرف القادم من الحبشة



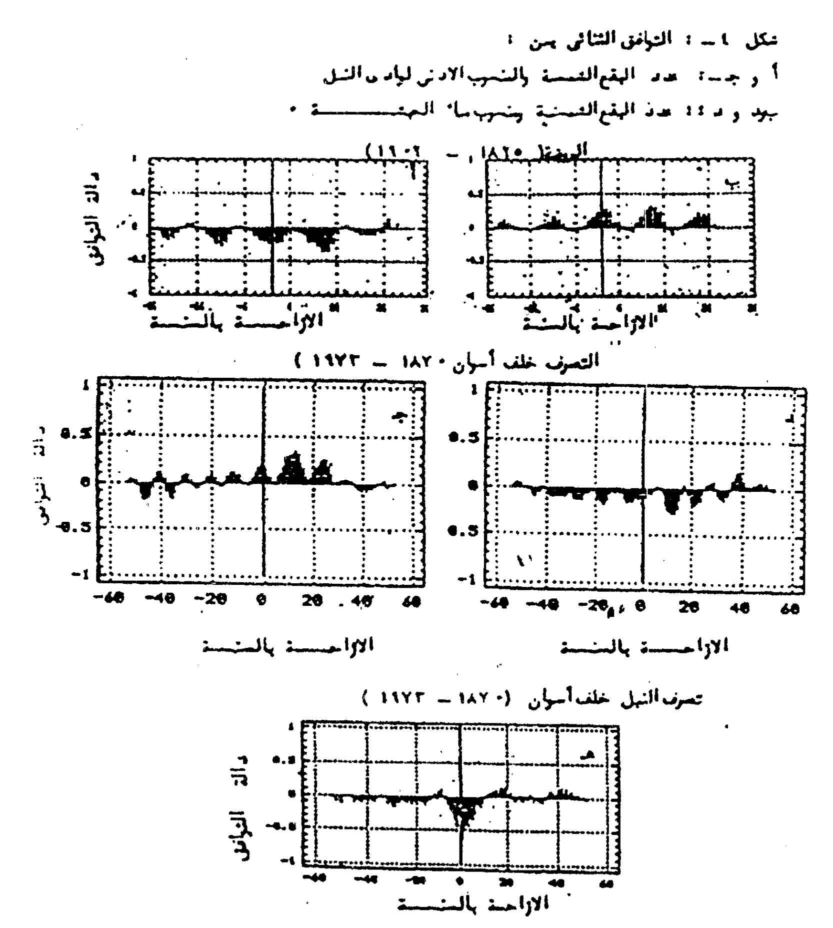
ب) التصرف القادم من منطقة البحـــيرات



شكل ٤ - : التوافق الثنائي بين :

أ و جـ : عدد البقع الشمسية بالمنسوب الادنى لوادي النيل

ب و د : عدد البقع الشمسية ومنسوب مياه الهضبة .



هـ - التوافق الثنائي بين كل من التصرف الادنى للنيل (الحركة الاستوائية) وتصرف الهضبة خلف أسوان في الفترة (١٨٧٠ - ١٩٧٣م) .

ويلاحظ على الدورات ما يلي:

أقوي الدورات في المصدر الاستوائي والمركبة الكلية هي دورة ١٩ عاما، وهي ثاني أقوي المركبات في بيانات النهاية العظمي للمستوي الفيضان وفي المركبة الاثيوبية، وهذا يتوافق مـــع نتـــائج (negm etal, 1989) وهذه المركبة ليس لها مقابل شمس ولكنها قريبة من دورة العقديـــة للقمـــر ١٨,٦ عاما، وهذا يؤكد دور القمر في هذه الفترة الزمنية.

جـــدول رقـــــم ١

دورات النيـــــل خـــلال الفـــترة ١٨٧٠ ـ ١٩٤٥

الشمس	التصرف الكلي	النسبة	الحبشة	البحيرات	القمة
25.3[2]					
	19.0*		19.0	19.0	19.0
		15.2			
	12.67[3]		12.67	12.67	12.67
10.86*					
	9.5[7]	9.5	9.5	9.5	9.5
7.6[3]	8.0[5]	7.6		7.6	
			6.91		6.91
	6.33[2]	6.33		6.33	
5.43[4]		5.43	5.07	5.43	5.07[10]
4.22[8]	4.22[4]	4.22	4.22	4.22	4.22
	3.8[8]	3.8	3.8	3.8	3.8
3.45[7]				3.45	
3.17[12]		3.17			
		3.04		3.04	
2.81[10]	2.81[6]			2.81	
2.62[13]		2.71	2.71		2.71
				2.45	
2.38[11]	2.3[10]		2.3		2.37
		2.24		2.24	
2.17[9]	2.11[9]		2.11		2.11
2.06[6]				2.05	
		2.0	2.0		2.0

ملحوظة :ـ

× أقـــوى الـــدورات

ـ الــرقـــم الـــى أعلـــى اليميـــن يرمز ألى القـــوة النسبيـــة للـــدورة

٢- أقوي الدورات في المصدر الاثيوبي هي ٢,٧١ عاما.

٣- الدورة ٢,٣٧ هي الدورة الثالثة من حيث مدها في النهاية العظمي.

٤- الدورات المتوافقة في جميع مصادر النيل هـــي : ٩,٥ - ٤,٢٢ - ٣,٨ عامـــا ، وتظهر الدورة ٩,٧ عاما في أشهر ابريل ومايو ويونية ويوليو **(negm etal, 1989)**

٥- الدورة ٢١,٦٧ مشتركة في **min Max** والمياه الاثيوبية.

٦– ثمان دورات ضعيفة تظهر أيضا في جميع بيانات النيل وهي ٧,٦ – ٥,٤٣ – ٤,٢٢ – ٣,٤٥ – ٣,١٧ – ٢,٨١ – ٣٨,٢ – ٢,٠٦ و ٢,٠ عاما.

II الدراسات القديمة

١– النيل في الفترة (٦٢٢ – ١٤٦٧) م البيانات العربية دونت منذ سنة الهجـرة – وتبعا (**Sami 1916**) فإن لكل ٣٤ سنة هجرية يوجد ٣٣ سنة شمسية، لـذا لـزم تحويلها إلى التقويم الميلادي.

٢– العلاقة بين المصدر الاستوائي والمصدر الاثيوبي بين الشكل (١٥ هيـدروجراف النهاية الصغري لمستوي النيل وبين الشكل (٥ب) هيدروجراف الفيضـان في نفـس الفترة، وحيث أن مستوي (**Min–max**) يشكل المصدر الاثيوبي – فان الشـكل (٥ج) يبين هذه العلاقة والتي تظهر أيضا العلاقة الموجبة والمتعاكسة في المصدر الاثيوبي والمصدر الاثيوبي.

ويرسم العلاقة بين النهايات الصغري والعظمي السنوية فإنه تنتج علاقات عامة، ولكن عند رسم فرق النهاية العظمي والصغري مع النهاية الصغري فإنه تنتج علاقة خطية واضحة شكل (١٦) تتمثل بالعلاقة:

$$(Max - Min) = a - m\ Min$$

حيث a = ١٥,٩٥٧   m = ٠,٨١١   بينما نقاس **Max, Min** بالذراع.

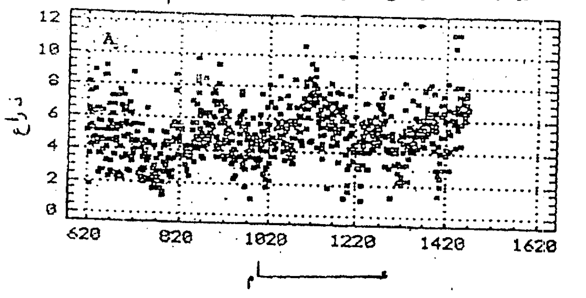
٣– الدورات العظمي للنيل:

شكل (٧) يمثل بيانات النهاية العظمي لمستوي نهر النيل عند الروضة متعمة بفلتر ١١ عاما، حيث تظهر بها التغيرات الدقيقة، ولكن نحصل على التغيرات ذات التردد المنخفض لمستوي الفيضان، فإن فلتر مشترك ٧٩ قد اجري على هذه البيانات والشكل (٧ب) يبين النتيجة.

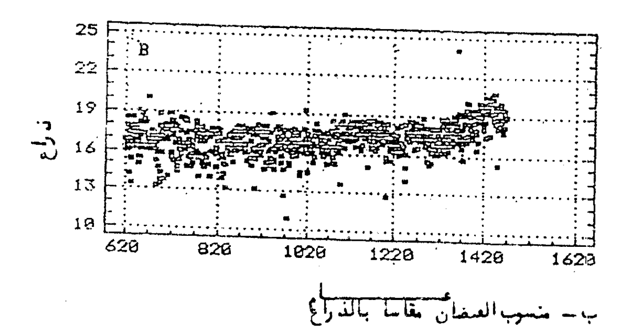
جدول (٢) مستوي فيضان النيل حقبة زمنية **Episodes**

السنين	الفترة الزمنية	أكبر مستوي	معدل التغير	حسن
٦٥٠)- ١٠٦٥	٤١٥	أقل من ١٧		(٦٥٠-١٠٧٠ أقل
١٠٦٥- ١١٤٥	٨٠	١٧,٠١ إلى ١٧,٦٤	+٠,٠٠٨.	١٠٧٠ - ١١٨٠الارتفاع السائد
١١٤٦- ١١٩٨	٥٢	١٧,٦٢ إلى ١٧,٤٨	+٠,٠٠٤	
١١٩٩- ١٣٢٧	١٢٨	١٦,٩٩ إلى ١٧,٤٨	+٠,٠٠٤	١١٨٠- ١٣٥٠ الأقل السائد
١٣٢٨- ١٤١٣	٨٤	١٧,٥٣إلى١٩,١١	٠,٠١٩	١٣٥٠ - ١٤٧٠ الارتفاع السائد

شكل ٥ – : هيدروجرافات النيل فى الفترة ٦٢٢ – ١٤٢٧ م

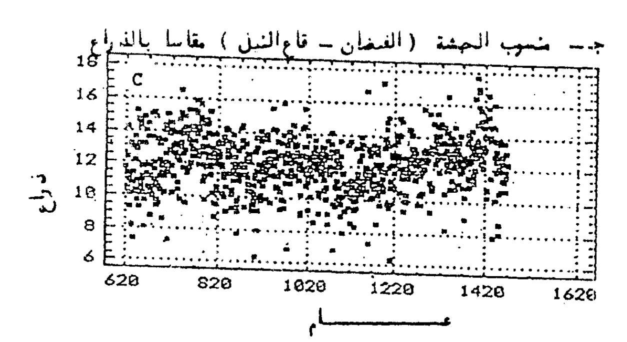


أ– قاع النيل مقاسا بالذراع

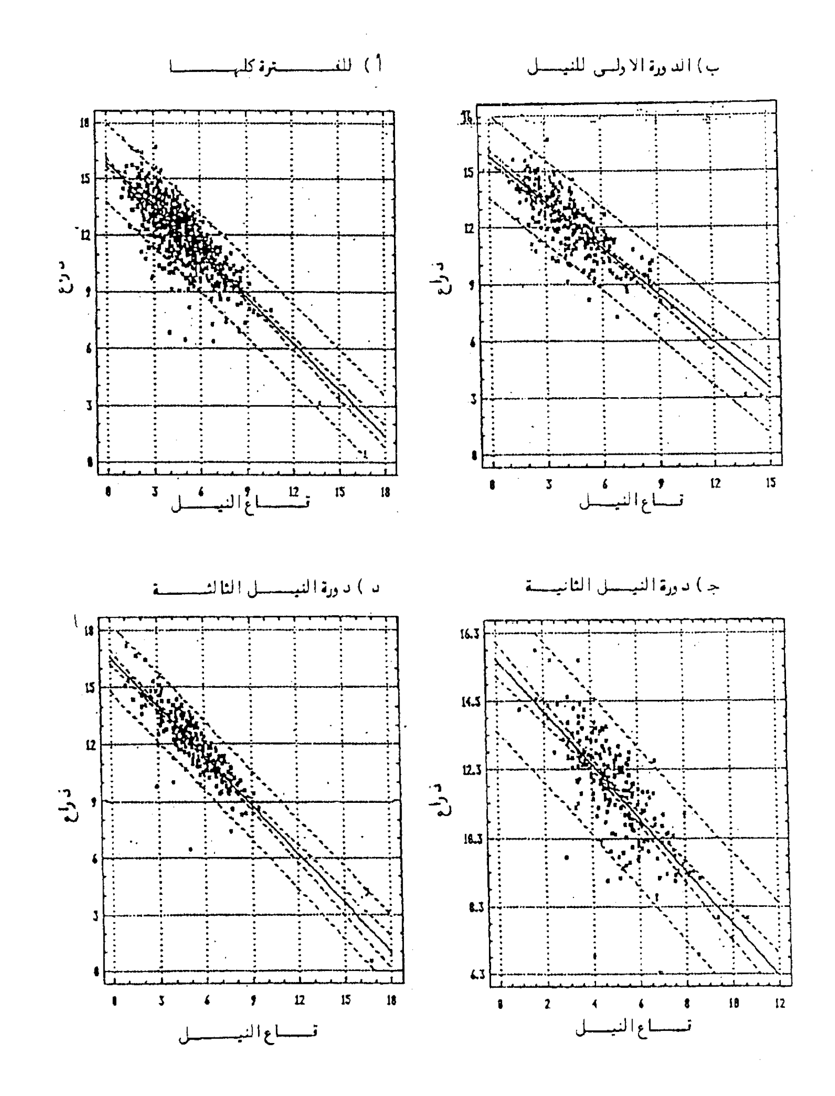


ب– منسوب الفيضان مقاسا بالذراع

جـ– منسوب الحشة (الفيضان – قاع النيل) مقاسا بالذراع

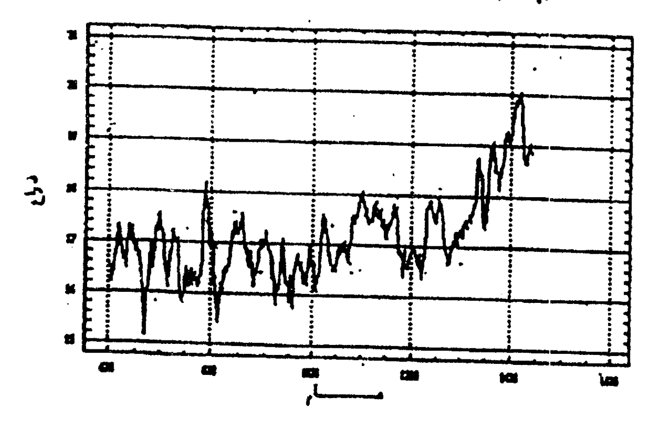


شكل ٦ : العلاقة الخطية بين منسوب الحبشة ومنسوب منطقة البحيرات

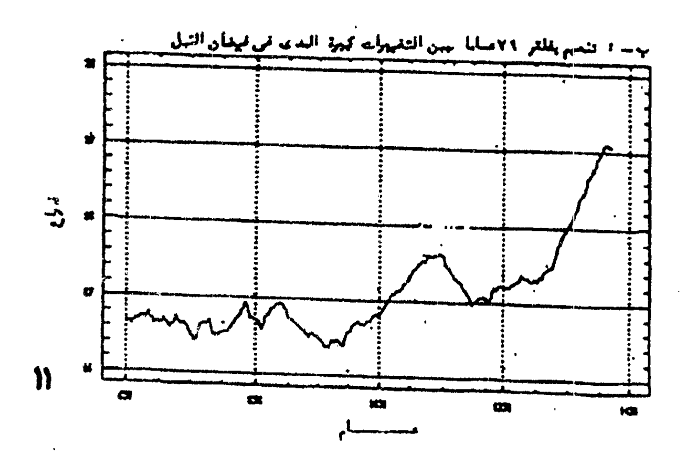


شكل ٢ـ : هيدروجرافات شماتي للمنسوب الأعلى للنيل :

أ ـ تعميم بفلتر ١١ سنة بين الدورات القصيرة للنيل



ب ـ : تعميم بفلتر ٢١ عاما بين التغيرات كبيرة المدى في فيضان النيل



ويبين جدول (٢) قائمة بدورات النيل العظمى آخذين في الاعتبار القيم المتعمة في بداية ونهاية كل دورة) ، وهي متفقة مع نتائج- حسن (١٩٨٩)، وخلال الفترة ٦٥٠-١٠٦٥م كان الفيضان أقل من ١٧ ذراع إلا أنه في خلال الفترة ١٠٦٥ - ١١٤٥ ارتفع الفيضان ثم انخفض من ١٧,٦٢ إلى ١٦,٩٧ ذراع، وتلا ذلك زيادة خلال الفترة ١١٩٩ - ١٣٢٧ ثم ارتفاع عظيم إلى ١٧,١١ ذراع في عام ١٤١٢

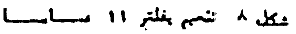
وعند الآخذ في الاعتبار ارتفاع قاع النيل (popper 1951.) يبدو أن تصرف النهر خلال الفترة ٦٥٠-١٤١٢ كان ثابتا إلى حد ما.

ويبين شكل (١٨، ب) التعميم إلى ١١ سنة للمركبة الاثيوبية والمركبة الاستوائية ؛ ويتبين من الشكل أن التغيرات قصيرة المدى في أحدهما تكون معكوسة في الآخر.

وفي شكل ٩ (١-ب) استخدام تنعيم ٧٩ سنة لكل من المركبتن الاثيوبية والنسبة بينهما وقد أختير هذا الفلتر لإزالة الدورات في حدود ٨٠ عاما ويبدو بوضوح من هذا الشكل ثلاث دورات رئيسية متعاكسة.
وقد دونت في جدول (٣) هو أربع النهايات العظمي والصغري لهذه الدورات وأول هذه الدورات هي أقواها وتتميز بمركبة اثيوبية (النسبة بين ٢,٨ و٥,٦) أما الدورتان الثانية والثالثة فيما أقل قوة وتتراوح النسبة في الدورة الثانية بين ٢,٢٤ و ٣,٣٧) وفي الدورة الثالثة ١,٨١ و ٣,٣٨.
٤- الدورات العظمي للشمس خلال الفترة ١١٥٠ إلى الوقت الحاضر بينما كانت المؤلفة الأولي مستخدم نتائج على الأشجار معمرة من شيلى لاستنباط معلومات فلكية منها (خليل ١٩٩٠) اكتشف أنه يتعيم معاملات حلقات الهجرة المعروفة باسم شيلى ٧ اوجاب ٤٧٩ الموجودة عند خط عرض ٤٦ ٣٣ جنوباً وخط طول ١٣ ٧٠ غربا وارتفاع ١٣٦٠ متر تعطي نتائجا تكاد تكون متطابقة مع الدورات العظمي الاستوائية للنيل.

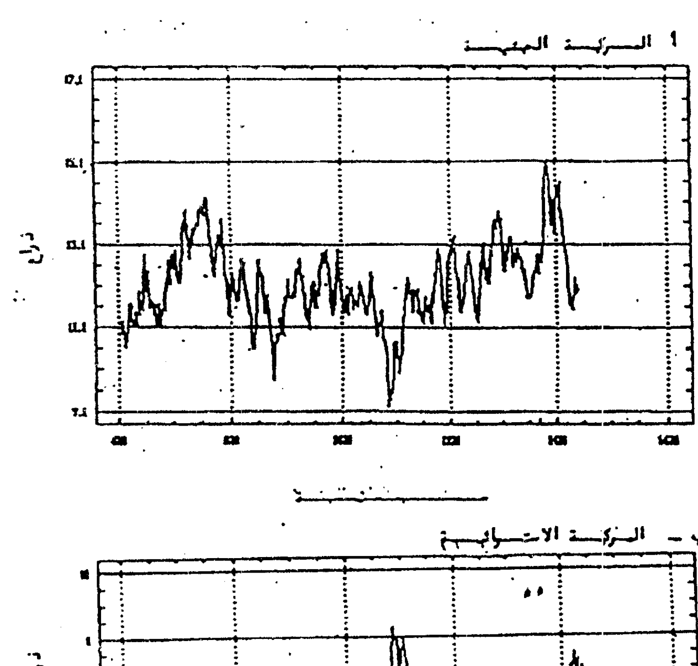
وان هذا التطابق المذهل رغم تباعد هذين المكانين يشير إلا وجود عامل كوني يربط بينهما إلا وهو الدورات العظمي للشمس، وفي هذه الحالة مكننا استنباط الدورات العظمي للشمس من هذه الهجرة أيضا.
ويوضح جدول (٤) قائمة بالنهايات العظمي والصغري لدورات الشمس العظمي المستنبطة من النيل ومن هجرة شيلى (٧) وتبين أن هناك انخفاض جديد عند **sporer minimum** وأقل عدة عند **Maunder minimum** وفي خلال الفترة ١٧٤٩ – ١٩٨٦ استخدام الإرصاد الشمسية لاشتقاق الدورات العظمي للشمس (شكل ٣د) وقد تبين منها بين عامي ١٨٩٠ – ١٩١٠ كان هناك حصيصا أتبعه قيمة في عام ١٩٥٩.

٥- تحليل بيانات النيل من خلال ثلاث دورات قسمت بيانات النيل إلى ثلاث أجزاء تتمثل دورات النيل العظمي ودونت تواريخ هذه الأجزاء في الجدول رقم ٣، أن الهدف من هذه التقسيم هو البحث عن اختلافات خلال هذه الدورات مما يلقي ضوءاً علـى النشاط الشمسي في تلك الفترات.

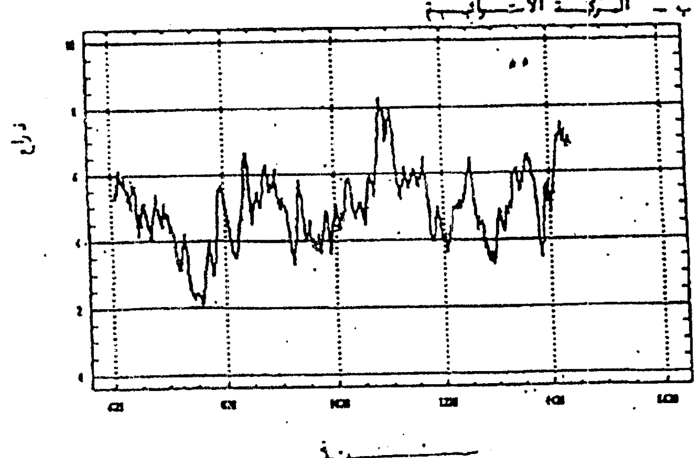


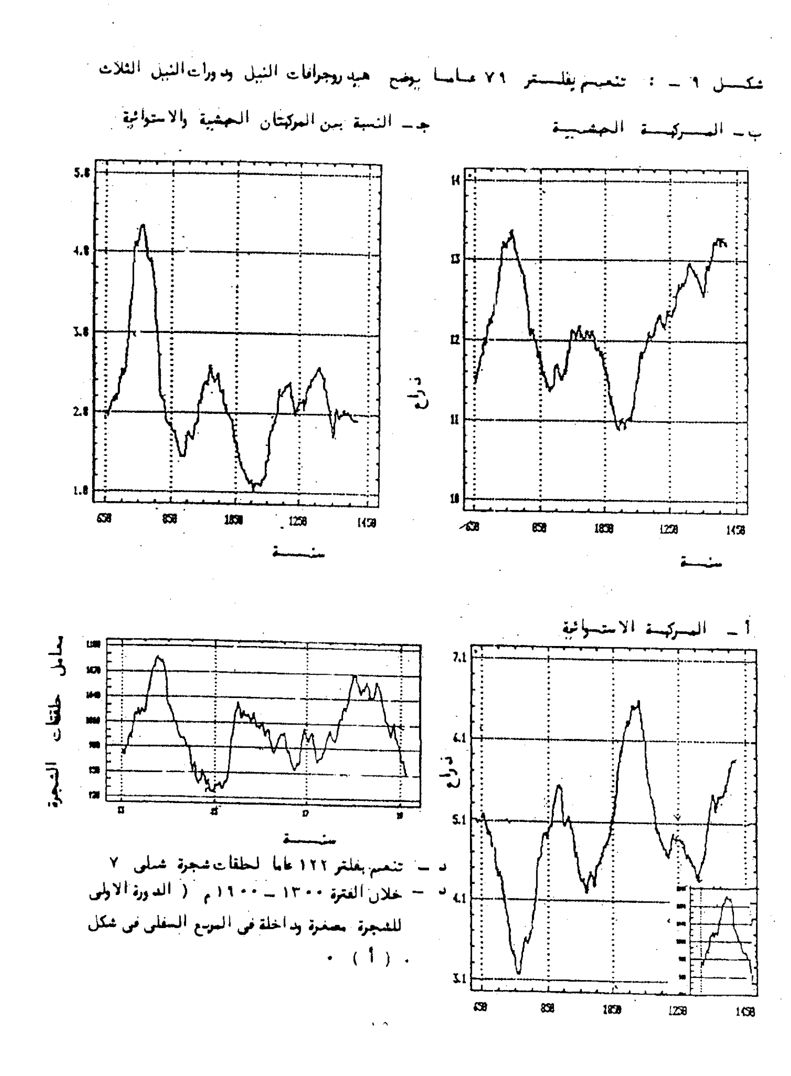
شكل ٨ تنعيم بفلتر ١١ ســاعــا

أ المركبة [illegible]



ب – المركبة الاستوائية





شكـــل ٩ ـ : تنعيـم بفلـــتر ٧٩ عـامـا يوضح هيدروجرافات النيل ودورات النيل الثلاث

د ـ تنعيم بفلتر ١٢٢ عاما لحلقات شجرة شملى ٧ ـ خلال الفترة ١٣٠٠ ـ ١٩٠٠ م (الدورة الاولى للشجرة مصغرة وداخلة في المربع السفلى فى شكل (أ) .

الــدورات العظمـــى للنيـــــل

جدول (٣)

	الدورة الاولى للنيل	الدورة الثانية للنيل	الدورة الثالثة للنيل
اثيوبيا	٦٥٠ - ٨٧٨	٨٧٩ - ١١٢٨	١١٢٩ - ١٣٥١
النسبة	٦٥٠ - ٨٨٦	٨٨٧ - ١١٠٧	١١٠٨ - ١٣٥١
اقل قيمة	٦٥٠ - ٨٨٦	٨٨٧ - ١١٢٩	١١٢٩ - ١٣٥١

جدول (٤)

	السنة		السنة
اكبر قيمة	٦٥٠	اكبر قيمة	١٥٦٤
اقل قيمة	٧٥٦	اقل قيمة Maunder min	١٦٤٩ - ١٦٩٩
اكبر قيمة	٨٨٦	اكبر قيمة	١٧٨٠
اقل قيمة	٩٨٦	اقل قيمة	١٨١١
اكبر قيمة	١١٢٩ Medieval Max	اكبر قيمة	١٨٤٨
اقل قيمة Wolf Minimum	١٢٢٦-١٣١٠	اقل قيمة	١٩٠١
اكبر قيمة	١٤٠٦-١٤١٩	اكبر قيمة	١٩٥٩
اقل قيمة	١٤٧٢ Sporer minimum		

ا- العلاقة الخطية بين المركبة الاثيوبية و المركبة الاستوائية :-

وجدت العلاقات الخطية الاتية بين هاتين المركبتين لكل من الدورات الثلاث. الا ان نسبة الخطا مرتفعة لذا وجب علينا البحث عن علاقات افضل :-

الدورة الاولى :-

(r= 0.79 Error 1,43)
Ethiopia = 15. 889- 0.82 Min

الدورة الثانية :

(r=0.74 Error 1.43)
Ethiopia = 15.559- 0.777 Min

الدورة الثالثة :

(r=0.85 Error= 0.92)
Ethiopia = 16.617 - 0.869 Min

النيل من ٦٢٢ الى ١٢٥١ م

(r=-0.79 Error= 1.06)
Ethiopia = 15. 957- 0.811 Min

ويمثل زيادة الجزء المقطوع في الدورة الثالثة للنيل الفيضانات العالية خلال هذه الفترة.

ب- العلاقة الاسية بين النسبة و المركبة الاستوائية رسمت العلاقة بين النسبة بين المركبات الاثيوبية الى الاستوائية كدالة في المركبة الاستوائية (شكل ١٠) ووجدت المعادلات الاتية :

الدورة الاولى للنيل

	Corr. Coef	Error
:Ratio = $17.808\ Min^{-1.276}$,	-0.981	0.102

الدورة الثانية للنيل

:Ratio = $18.643\ Min^{-1.305}$,	-0.970	0.103

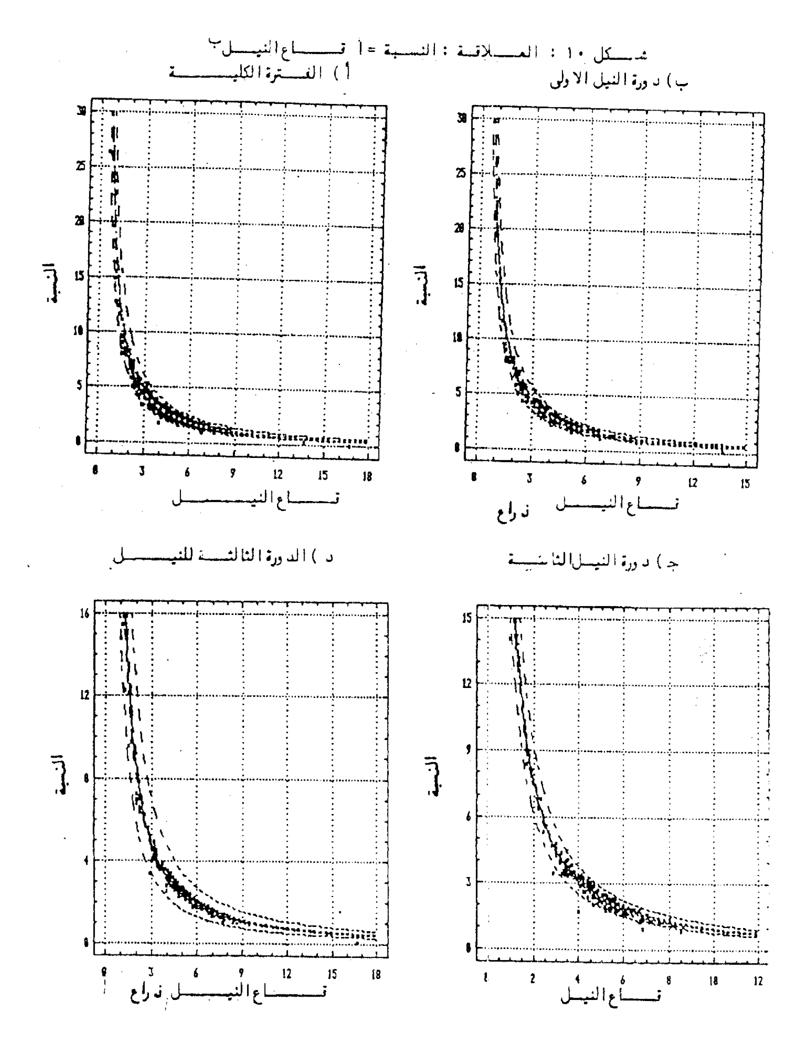
الدورة الثالثة للنيل

:Ratio = $19.019\ Min^{-1.287}$,	-0.985	0.080

النيل ٦٢٢- ١٤٦٧

:Ratio = $17.82\ Min^{-1.256}$,	-0.953	0.101

وتتميز هذه العلاقات عامل توافق عال جدا وبنسبة اخطاء منخفضة جدا.



وهذه المعادلات ذات أهمية خاصة لأنه بمجرد تحديد تصرف النيل الآدني في سنة ما فإنه يمكن حساب النسبة المتوقعة بين الركبتان الحبشية والاستوائية ومن ثم قيمة التصرف المتوقع من الحبشة، وبالإشافة المركبة الحبشية إلى المركبة الاستوائية يمكن حساب تصرف الفيضان وفي الفترة الحديثة.

استخدام تصرف النيل خلف خزان أسوان مقدراً بالمليار متر مكعب ورسمت العلاقة بين لوغارتيم المتغيرين شكل (١١ – ب) فوجد

Ln Ratio (1871 – 1988) = 3.099 – 1.30 in Min
(Corr , Coef = 0 .88 , Error = 0.23

٦- دورات النيل خلال الفترة ٦٢٢ - ١٤٢٠م

تم حساب دورات النيل لكل من المركبتان الأثيوبية والاستوائية وللفيضان باستخدام برنامج STATGRAPHIC MANUAL وتبدو النتائج في شكل ١٢ (أ -ب)

وفي شكل ١٣ يبدو جزء من النتائج مكبر).

وقد جدولت نتائج الدورات في الجدول رق (٥) لكل من المركبة الاستوائية والمركبة الاثيوبية وفيما يلي تقدم تعليقا على هذا الجدول.

١- أن أقوي دورة في كل من المركبتان الحبشية والاستوائية في ٢٦٥,٩٦ سنة ودوراقا التوافقية ١٣٢,٩٨ و ٨٨,٦٥ و ٦٦,٤٩ سنة ؟ أي ٢/٥ و٣/٥ و٤/٥ على الترتيب وتعتبر دورة ١٣٢,٩٨ سنة تاتي أقوي الدورات في حالة المركبة الاستوائية إلا أنها ضعيفة في حالة المركبة الاثوبية.

٢- معتبر دورة ٨٠ عاما ٧٩,٨١ كانت الدورات الاستوائية قوة ولكنها ضعيفة في حالة المركبة الاثيوبية وقد ذكرت هذه لدورة في (شلتوت ١٩٨٩).

٣- أن ثاني الدورات الاثيوبية قوة هي ٥٥,٥٦ سنة وهي ايضا موجودة في المركبة الاستوائية.

٤- أما الدورة الثالثة الاثيوبية فهي دورة ٦٦,٤٩ عاما.

٥- وجدت دورات حول ٢٢ سنة وهي محققة مع الدورة المغناطيسية للشمس ومع الظواهر الجوية Herman and Gold berg 1978.

شكل (١١) العلاقة بين النسبة والتصرف الادنى للنهر الطبيعي عند أسوان خلال الفترة (١٨٧١ ـ ١٩٩٢) .

أ) النسبة = أ التصرف الادنى ب

النسبة

30
25
20
15
10
5
0

0 1 2 3 4 5

التصرف الادنى (مليار متر ٣)

ب) لو النسبة = لو أ ـ ب لو التصرف الادنى

النسبة

100
10
1

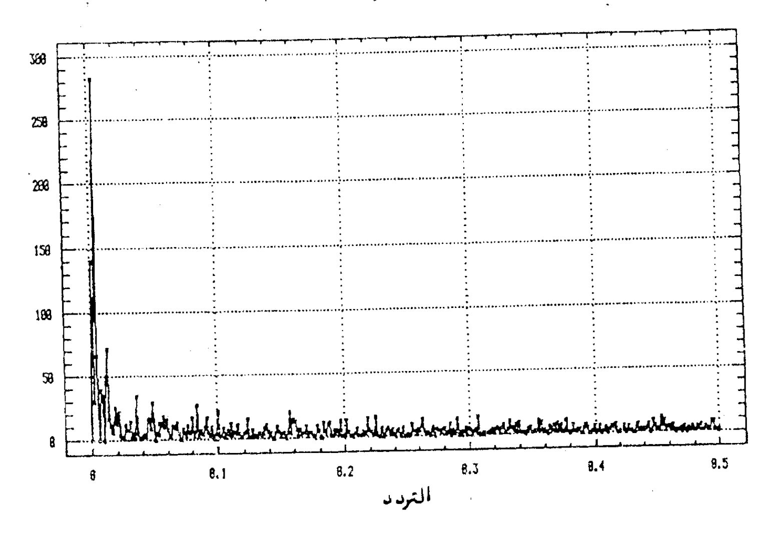
0.1 1 10

لو التصرف الادنى

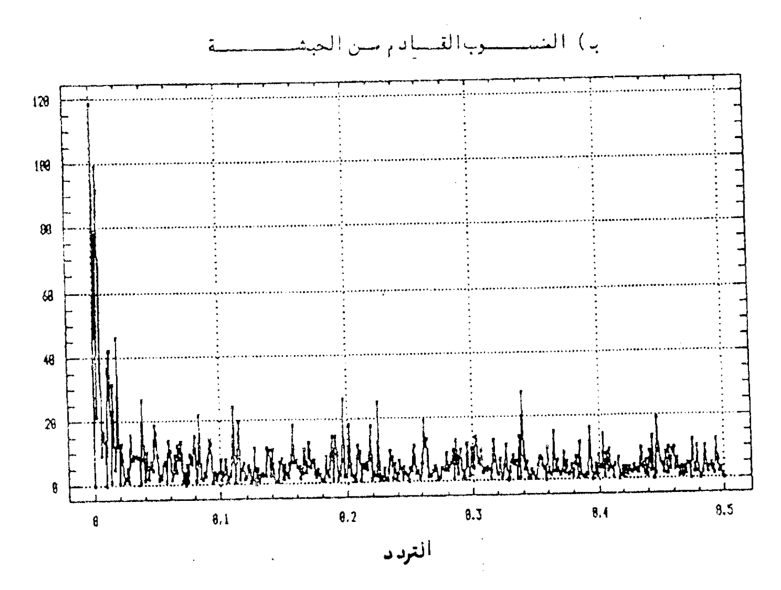
مليار متر مكعب

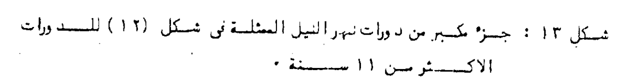
شكل ١٢ : الدورات الخاصة بنهر النيل خلال الفترة ٦٢٢ ـ ١٤٢٠ م.

أ) المنسوب القادم من هضبة البحيرات (المنسوب الادنى)

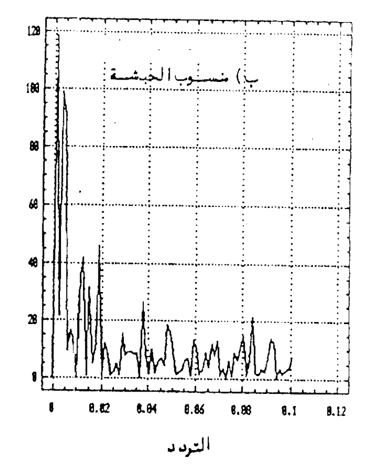


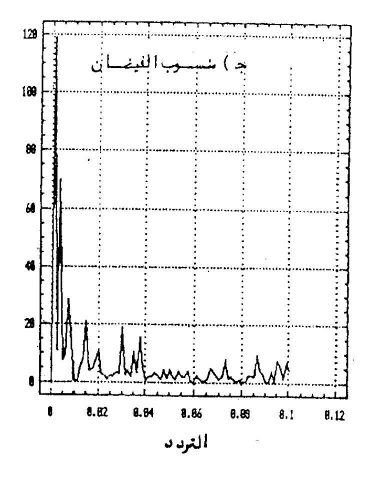
ب) المنسوب القادم من الحبشة

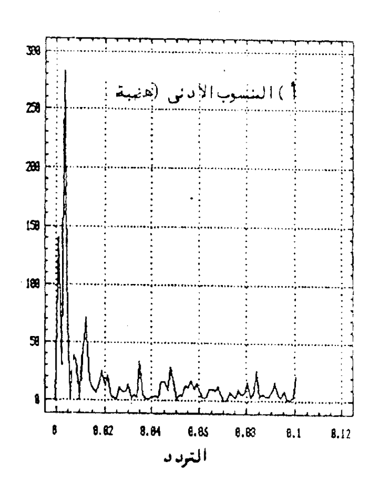


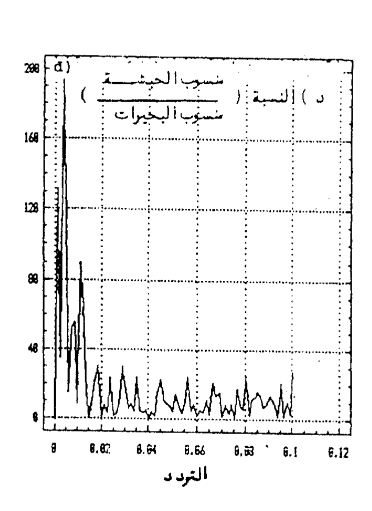


شكل ١٣ : جزء مكبر من دورات نهر النيل الممثلة في شكل (١٢) للدورات الاكثر من ١١ سنة .









جدول (٥)

التغيرات الزمنية لمياه النيل خلال الفترة ٦٢٢– ١٤٢٠ ميلادية

السنوات

الـــــل	٢٦٥ر٩٦	١٣٢ر٩٨	٧٩ر٨١	٥٥ر٥٦	٤٦ر٩٥	٣٧ر٩٩			
اكبر - اقل	٢٦٥ر٩٦	١٣٢ر٩٨	٨٨٠٦٥	٧٩ر٨١	٦٦ر٤٩	٥٥ر٥٦			
الـــــل	٣٣ر٢٤	٢٨ر٤٩	٢٢ر١٧	٢٠ر٩٩	١٧ر٧٣	١٦ر٩٨	١٤ر٧٨		
اكبر - اقل	٣٣ر٢٤	٢٦ر٦	٢٢ر٨	٢٠ر٩٩	١٧ر٠٠	١٦ر٩٨	١٥ر٥٦	١٥ر٦٠	١٤ر٥١
اقل قيمة	١٢ر٤٧	١١ر٩١	١٠ر٩٣	٩ر٠٧	٨ر١٤	٦ر٣٨			
اكبر - اقل	١٢ر٨٧	١٢ر٠٩	١٠ر٩٣	١٠ر١	٩ر٦١	٩ر٠٧	٨ر١٤	٦ر٣٨	
اقل قيمة	٥ر٤٧	٥ر٠٨	٥ر٥٩	٤ر٥٩	٣ر٥٨				
اكبر - اقل	٥ر٤٧	٥ر١٠	٤ر٩٦	٤ر٥٩	٤ر٤٦	٤ر١٣	٣ر٤٨	٣ر٤٤	٣ر٣١
اقل قيمة	٣ر٠٥								
اكبر - اقل	٢ر٩٤	٢ر٦٥	٢ر٥٦	٢ر٣٧	٢ر٢				

٧- التغيرات الدورية خلال الثلاث دورات الرئيسية لنهر النيل

يتضح من أشكال ١٤ – ١٥ – ١٦ – لفيضان النيل وهذا للمنسوب الادنى وللمركبة الحبشية لدورات النيل الثلاث والمدونة نتائجها في الجدول(رقم ٦-٤) متضح النتائج الحالية:

أ- وجود دورة ١٨,٨٦ سنة وهي تبين تأثير دورة العقد القمرية على المركبة الاستوائية للنيل.

ب- هذا وقد أعتبر (**cuttie/1991**) دورة ١٦ سنة ذات أصل شمسي – قمري يعود إلى الجاذبية ، وقد تبين اختلاف قيمة هذه الدورة تبعا للزمان والمكان كما هو متضح من أختلاف قيمة هذه الدورة لكل من المركبة الحبشية والمركبة الاستوائية خلال دورات النيل الثلاث.

ت- في حالة الدورة الأولي للنيل، كانت دورة ٢,٩١ عاما في مياه الحبشة هي أشد الدورات على الإطلاق، بينما كانت الدورتان ٣,٣١ و ٣,١٣ سنة هما أشد الدورات في المياه الاثوبية خلال الدورة الثانية للنيل. ولعلنا نستطيع أن نعري هذه الدورات إلى دورات مماثلة في المجال المغناطيسي للأرض نتيجة للتأثيرات الشمسية على طبقة الايونيوسفير.

ث- في أثناء الدورة الثانية للنيل كانت أشد الدورة قوة هي ١٤,٨ و ١٠,٠٩ و ٣,٣١ سنة لكل من المركبة الاستوائية والفيضان والمركبة الحبشية على الترتيب.

ج- وجدت الدورات التوافقية الآتية في حالة المركبة الاستوائية للدورة الثانية للنيل : ٤٤,٠٤ و ٢٢,٢ سنة وكانت دورة ٤٤,٤ سنة هي ثاني أشد الدورات قوة، وتعزي هذه الدورات إلى دورة ال ٢٢ عاما المغناطيسية للشمس.

ح- في حالة الدورة الثالثة للنيل – كانت دورة الآخ عفر سنة ثاني الدورات الاستوائية قوة بينما كانت الرابعة في المياه الاثيوبية.

خ- كانت دورة الثمانون عاما أقوي الدورات الاثوبية للدورة الثالثة للنيل وقد وجدت مركباتها التوافقية.

٨- التوافقات الثانية بين مياه المنطقة الاثيوبية ومياه المنطقة الاستوائية.

قد أجريت حسابات التوافقات الثنائية لكل الفترة القديمة وكذلك لكل من الدورات الثلاث وتظهر المرسومات البيانية في شكل (٧) أ ، ب ، ج،، أعلى الترتيب.

وعند اعتبار جميع البيانات في الفترة القديمة واستخدام زمن تأخير قدرة ثلاثمائة عام – ظهرت دورة واضحة تعلق عليها فيما يلى:

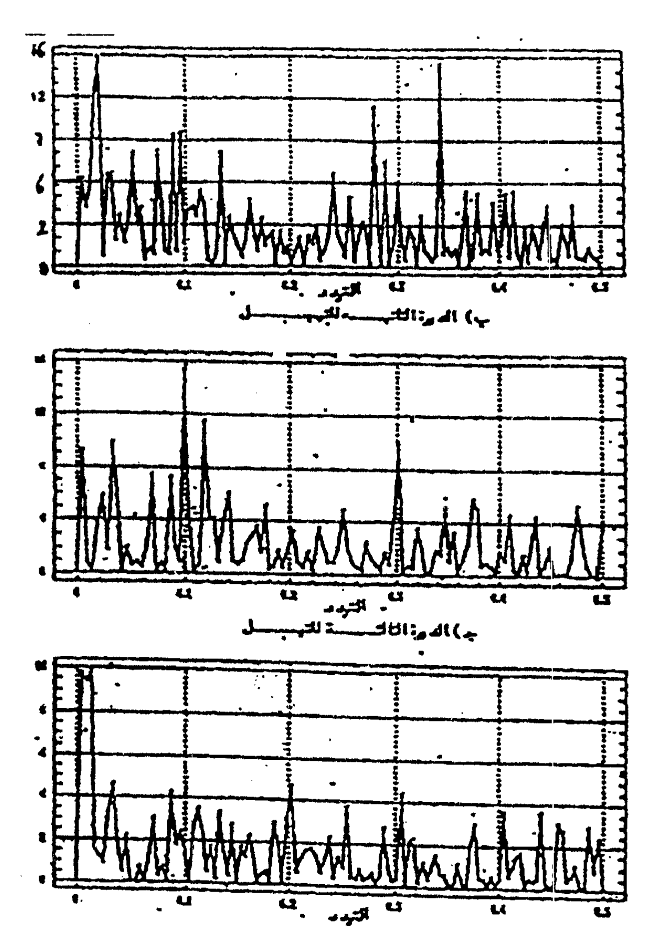
أ- أن المتغيرات يتوافقان عكسيا – وعند زمن تأخير – صفر كان معامل التوافق – ٠,٨ .

ب- هناك تغيرا تدريجيا من السالب إلي الموجب خلال دورة قدرها ١٣١ عاما في المتوسط _ ويبلغ زمن التأخير صفرا بعد حوالي ثمانون عاما ٠

ت- يوجد دورة أساسية قدرها ٢٦٦+١ عاما بين القمتين المتتاليين ٠ وقد وجدت هذه الدورة مسبقا في كل من المركبتين الاثيوبية والاستوائية للفترة القديمة كلها (انظر جدول ٥) آما في حالة الدورة الأولى للنيل فيمكننا القول أنة في حالة زمن تأخير مساويا للصفر كان معامل التوافق ٨و٠٠ وبعد ٥٢ عاما تلاشي معامل التوافق ثم اصبح موجبا بين المركبتا الاستوائية والحبشية وتذبذب معامل التوافق بين سالب وموجب خلال الفترة ٥٢و٧٢ عاما و- ٥٨ و – ٧١ عاما ٠

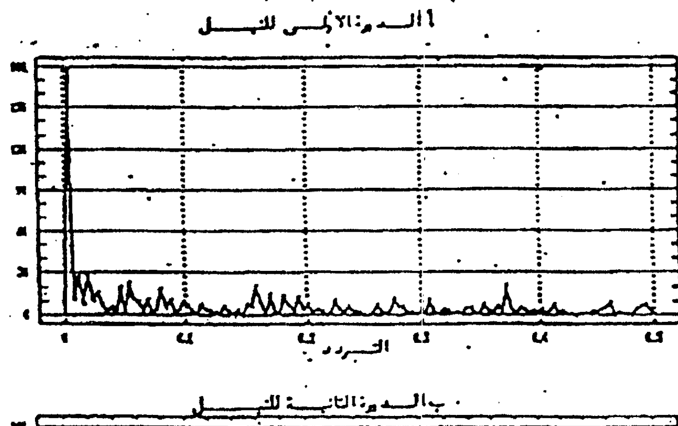
شكل 14 : الدورات الخاصة بفيضان النيل

أ) الدورة الأولى للنيل

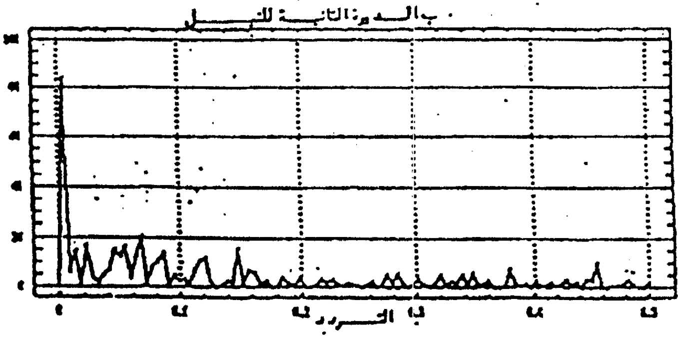


شكل ١٥ الدورات الثابتة بالنسيج الناتج من شقة الحراج.

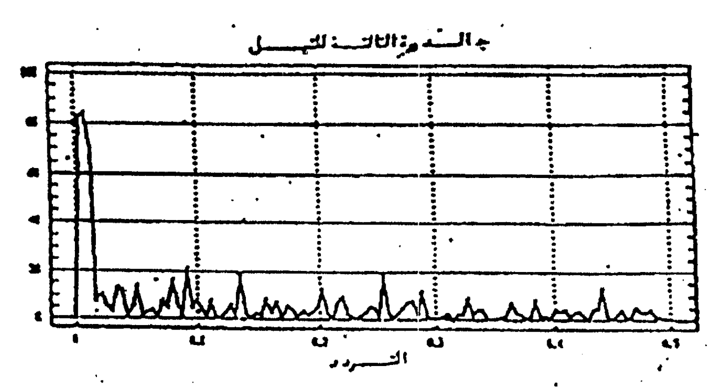
أ الدورة الأولى للنيل



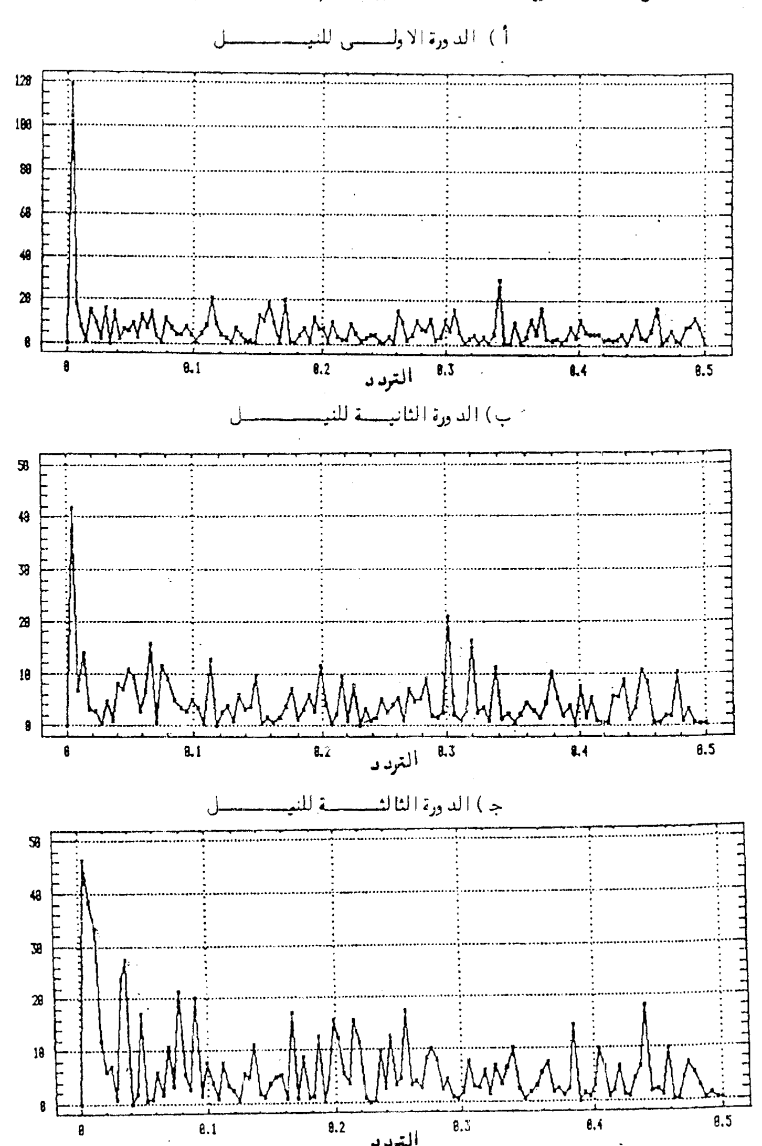
ب الدورة الثانية للنيل



ج الدورة الثالثة للنيل



شكل ١٦ : الدورات الخاصة بالمنسوب القادم من الحبشة لدورات النيل الثلاث

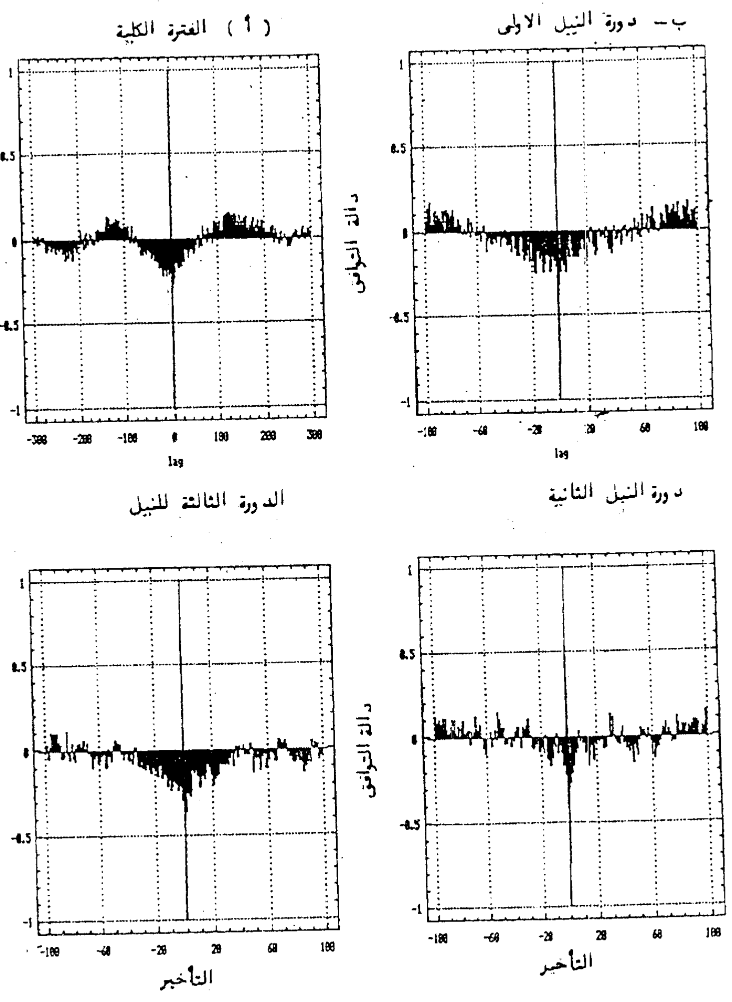


جـــدول رقـــم ٦

التغيـرات الـزمنيـــة لثـلاث دورات للـنيـل

الحبشـــة			القمـــة		هضبـة البحيرات		
1	2	3	1	2	1	2	3
88^{2}		121*					80.6*
	74^{6}					74^{4}	
52.8*			52.8*		52.8		
	44.4^{2}	48.4		44.4			40.3
3 7 .7		30.24	33.0	31.72^{3}	33.0		26.4
26.4			26.9^{2}				
22.0^{6}	22.2^{5}	20.16^{6}	20.3			20.18	20.16^{6}
18.86^{3}	18.5^{3}		17.6		16.6		16.13
14.67	14.8*			14.8^{4}		14.8	14.23
			13.9			13.06	
12.57^{7}		12.74^{4}			12.57		12.73^{3}
11.48	11.68^{7}	11.0^{2}	11.5	11.68^{5}			11.0^{4}
10.55	10.57	10.08	10.6^{4}	10.09*			10.08
8.8	8.22	8.96	8.8,9.4	8.54^{2}	8.8^{5}	8.88	8.96
		7.81					7.81
7.54		7.33	7.54	7.16^{6}	7.33	7.0	7.33
6.6	6.73^{4}	6.37			6.6^{7}		6.37
6.29^{4}	6.43	6.05	6.29		6.29^{2}		6.04
5.87				5.69	5.87		5.76
5.5							5.38
5.18	5.05	4.94^{8}			4.98	5.05	5.04
4.47		4.57	4.19				4.6,4.2
				4.04			4.1
		3.9^{3}	3.94				3.9
3.62	3.64		3.62		3.62		3.61
	3.52	3.56					
		3.46	3.47		3.47		
3.26			3.34		3.3	3.31*	3.27
	3.13	3.06		3.13^{4}		3.13^{2}	3.14
2.69	2.75	2.93		2.9,2.7	2.91*	2.96	2.9
	2.0	2.6,2.4		2.44		2.6,2.2	2.6

شكل ١٧ – التوافق الثنائي بين المركبتان الحبشية والاستوائية



وفي حالة الدورة الثانية للنيل – كان معامل التوافق – ٠,٧٤ عند زمن تأخير مساويا للصفر وظهرت دورات قدرها ١٥ عاما . هذا وقد رصدت من قبل دورة قوية جدا قدرها ١٤,٨ سنة في المياه الاستوائية (انظر جدول رقم ٦) ويتضح أنة خلال الدورة الثانية للنيل حدث تغيرا جوهريا في التوافق الثنائي بين المركبتان الاستوائية والأثيوبية بالمقارنة للدورتين الأولى والثالثة .

وفي حالة الدورة الثالثة عند زمن تأخير = صفر كان معامل التوافق – ٠,٨٥ ، واستمر التوافق السالب لمدة ٣٣ عاما وظهرت دورة الأحد عشر عاما

ثم تذبذب المعامل بين سالب وموجب الا أن العلاقة السالبة كانت هي السائدة .

٩- التردد النسبي بين مياه النيل في الفترة ٦٢٢ - ١٤٦٧ م

أنه من المهم معرفة متوسطات الفيضان والمركبتان الاثيوبية والاستوائية للنيل والنسبة بينهما ، ويمثل شكلا ١٨ ، ١٩ التردد لمياه اثيوبيا ومنطقة البحيرات مقدرتان بالذراع لكل منهما ودونت النتائج بالجدول (رقم ٧) ويبين العمود الأخير بالجدول تصرف النيل حديثا منذ عاما ١٨٧٠ ٠

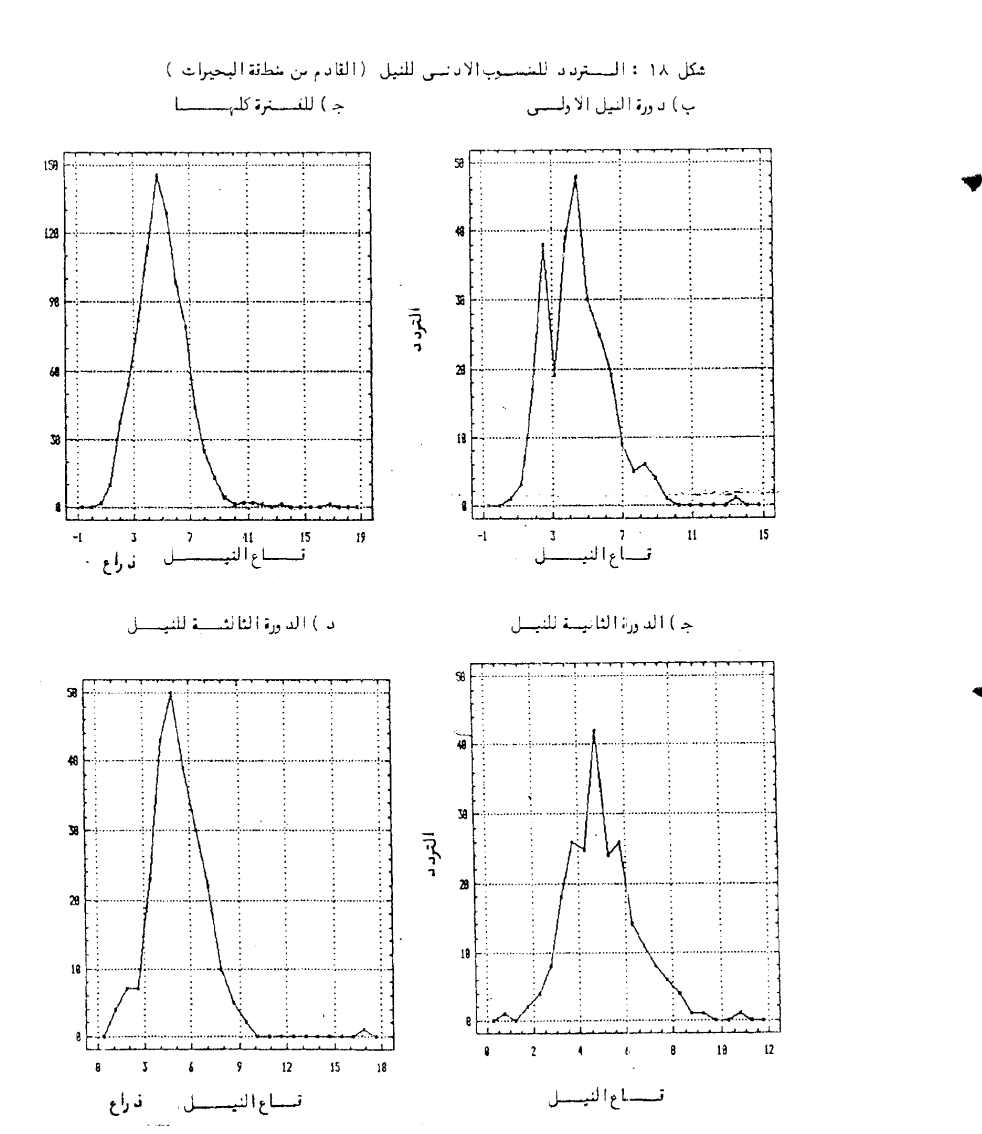
ويتضح من هذا الجدول أن أعلي فيضان رصد خلال الفترة من ٦٢٢ - ١٤٦٧ كان ٢٤ ذراعا في سنة ١٣٦٠ م أي ما يعادل نحو ٣١٦٠٠ مليون مترا مكعبا ٠ وهو مقارب لتصرف لفيضان عام ١٨٧٨ وهو اعلي فيضان رصد حديثا حيث كان تصرفه ٣٢٠٠٠ مليون مترا مكعبا ٠

اما متوسط الفيضانات خلال الفترة القديمة فكان ٢٤١٠٠ مليون متر مكعب وقدر متوسط تصرف النيل السنوي ب ٩٧٦٠٠ مليون متر مكعب وهو مقارب ايضا للمتوسطات الحالية المقدرة ٩٢٨٠٠ مليون متر مكعب خلال الفترة من (١٨٧٠ - ١٩٤٥) ٠

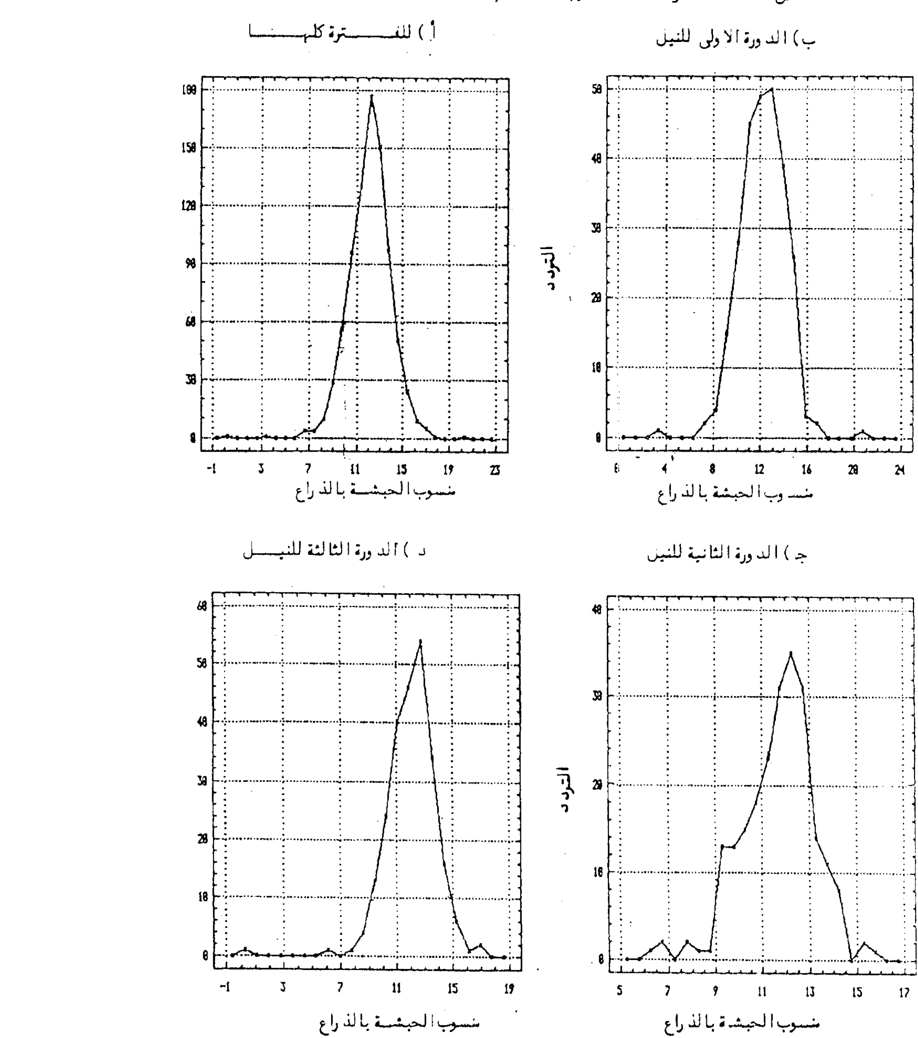
ومن ناحية أخري كان أدني فيضان حدث في الفترة القديمة هو فيضان عام ٩٧٥ م الذي بلغ تصرفه أكبر من فيضان عام ١٩١٣ - ويعد هذا مؤشرا مخيفا لقسوة حالة الجفاف التي عانت منها الحبشة حديثا ٠

وباختصار ، يمكننا القول أن متوسط الفيضانات واعلاها في الفترة ٦٢٢ - ١٤٦٧ م تتفق الي حد كبير مع الفيضانات في العصر الحديث ٠

شكل ١٨ : التردد للمنسوب الادنى للنيل (القادم من منطقة البحيرات)



شكل ١٩ : التردد للمنسوب القادم من الحبشة



جدول (٧) : اقل واكبر والمتوسط صرف النيل خلال ٦٢٢ - ١٤٦٧ م بالمقارنة بالنسبة المئوية للصرف

اكبر قيمة للفيضان	اقل قيمة	اكبر قيمة - اقل قيمة	النسبة	ل حديثا
الاقل ٨٣ر١٠ (٩٧٥)	١ (٩٨١)	٣٥ر٦ (٩٠٤)	٦٩ر (١٤٣٦)	(١٩١٣)
اكبر صرف ١٢٤٠٠				١٢٢٠٠
الصرف السنوى ٥٢٠٠٠				٤٥٦٣٠
الاكبر ٢٤	١٢ (١٣٦٠)	٧٥ر١٧ (١٤٠٤)	٥ر١٥ (١١٩٣)	
اكبر قيمة للصرف ٣١٦٠٠				٣٢٠٠٠ (١٨٧٨)
الصرف (السنوى ١٢٧٠٠٠	٣٩٤٠٠)			١٢٨٠٠٠ (١٨٧٨)
المتوسط بالذراع ١٥ر١٧	٩٩ر٤	١٦ر١٢	٩١ر٢	(١٨٧١ ـ ١٩٨٨)
اكبر قيمة للصرف ٢٤١٠٠				٢١٤٢٠
الصرف السنوى ٩٧٦٠٠				٨٨٤٤٠

وكان أقل مستوي لقاع النيل (المياه الاستوائية) هو ذراعا واحدا في عام ٩٨١ م بينما كان أعلي مستوي له ١٢ ذراعا في عام ١٣٦٠ ، ويعكس ذلك فترات الجفاف والامطار الشديدة علي منطقة البحيرات الاستوائية .

وكانت متوسط المركبة الاثيوبية نحو ١٢,١٦ ذراعا بينما كان أدناها ٤,٩٩ ذراعا .

وأنة لمن المهم بمكان حساب النسبة بين مساهمتا كل من أثيوبيا والمنطقة الاثيوبية والمنطقة الاستوائية في مياه النيل في مصر مستخدمين العلاقة:

$$\text{(Ratio) النسبة} = \frac{\text{Max - Min}}{\text{Min}} = \frac{\text{المركبة الحبشية}}{\text{المركبة الاستوائية}}$$

وقد وجد أن أقل نسبة كانت ٠,٦٩ في عام ١٤٣٦ أي أن نحو ٤٠,٨ % حينئذ كانت قادمة من الحبشة بينما كانت ٥٩,٢ % قادمة من منطقة البحيرات الاستوائية .

ومن ناحية أخري كانت أعلي قيمة للنسبة هي ٥١,٤٧ في عام ١١٩٣ م ـــ حيث كـــان ٩٣,٩٣ % من مياه النيل من المركبة الاثيوبية بينما تناقص اسهام هضبة البحيرات إلي نحـــو ٦,٠٧ % ومن هذا يتضح أن مساهمة كل من منبعي النيل هي مساهمة متغيرة ، ويبلغ متوسط RATIO أي أن مساهمة الحبشة المتوسطة خلال ٦٢٢ – ١٤٦٧ كانت ٧٤,٤ بينما كانت مســـاهمة منطقـــة البحيرات ٢٥,٦ % وقد قدرت هذه النسبة علي اعتبار أدني ارتفاع للنيل المعروف عند العرب باسم قاع النيل وأقصي ارتفاع النيل عند الفيضان

١٠ – الجفاف والامطار الشديدة في مصادر المنطقة الاثيوبية والمنطقة الاستوائية في الفتـــرة ٦٢٢ – ١٤٦٧ م

بفضل مركبتا النيل الاثيوبية والاستوائية ووضع الحدود الآتية ٠

جفاف في الحبشة المنسوب ١٠ ذراع أمطار شديدة المنسوب ١٥ ذراع

جفاف في المنطقة الاستوائية المنسوب ٢ ذراع أمطار شديدة ٧ ذراع

وعلي هذا الأساس أعدت قائمة لكل من فترات الجفاف والأمطار الشديدة في منبعي النيـــل للفترة ٦٢٢ – ١٤٦٧ م وهي المبينة في الجدول (رقم ٨) وفي خلالها كان هناك تسعون عاما مـــن الأمطار الشديدة في المنطقة الاستوائية و٣٧ عاما مثلهما في الحبشة ، بينما كان هناك ٢٥ عاما مـــن الجفاف في المنطقة الاستوائية بالمقارنة إلي ٨١ عاما من المسقط في الحبشة أي ان الحبشة كانت اكثـــر تعرضا للجفاف واقل تعرضا للأمطار الغزيرة من منطقة البحيرات وسجل عام ١٣٦٠ م اكثر الأعوام شديدة في غزارة الأمطار في البحيرات بينما كان عام ٩٨١ أشدها قحطا ٠

أما في حالة الحبشة فكان عامي ٩٠٤ م و١٢١١ م اشدها قسوة حيـــث بلغـــت المركبـــة الحبشية ٦,٣٥ و ٤,٦ ذراعا على الترتيب وكان عام ١٤٠٤ أكثر الأعوام غـــزارة في الأمطـــار في الحبشة (١٧,٧٥ ذراعا) وقد نشر (Degfu 1987) قائمة بفترات جفاف التي عانت منها الحبشة في الفترة ٢٥٣ ق ٠ م الي ١٩٨١ ألا آن هذه القائمة كانت غير كامل كما أوضح المؤلـــف بسبب عدم وجود تسجيلات يعتمد عليها

وقد ذكر Degfu ست مجاعات خلال هذه الفترة كـــان أحـــدها في الفتـــرة ١٠٦٦ – ١٠٧٢ م حيث ذكر أن كلا من الحبشة ومصر تعرضتا لمجاعة في ذلك الوقت ٠

وقد سجل ابن اياس أعوام ١٠٦٣ – ١٠٧٠ أعوام مجاعة في مصر كما ذكر ذلك ســـامي (١٩١٦)

ويتضح من جدول (٨) آن أعوام ١٠٦٣ – ١٠٦٧ يذكر آن هناك ثمان سنوات مـــن الجفـــاف تعرضت لها British Colombia خلال الأعوام ١٠٤٥ – ١٠٦٦ م كما ذكر باســـتخدام

حلقات الشجر (yousef 1993) وكذلك أوضحت حلقات الشجر من شـيلي باسـتخدام الشجرة (fla 479) (a March et a 1979 الموجودة علي خط عرض – ٣٩ ٣٢ أن السنتين ١٠٤٥ – ١٠٥٢ كانت سنتين جفاف في شيلي لذلك يبدو أن هناك ٧ أو ٨ سـنين مـن الجفاف احتاجت العالم خلال هذه الفترات ٠

كذلك اوضح Degfu أن السنوات ١٢٧٢ و ١٢٧٣ و ١٢٧٤ و ١٢٧٥ كانـت سنوات جفاف في الحبشة الا ان (جدول ٨) يحدد سنوات ١٢٧٠ ، ١٢٧٣ فقط كسنوات جفاف في المنطقة ٠

كذلك اوضح Degfu أعوام ١٤٣٥ – ١٤٣٦ سنوات جفاف ويشير جدولنا إلي عام ١٤٣٦ كعام جفاف ومن ناحية أخري سجل Degfu أعوام قحط في الحبشة وهذا يتعـارض مـع جدول (٨) وتعد القائمة المبينة في جدول (٨) للجفاف والامطار الشديدة في منطقتا الحبشـة والبحيرات قائمة متكاملة ودقيقة لبضع سنوات علي وجه العموم فأن الجفاف في الحبشـة يعادلـه فيضانات في منطقة البحيرات والعكس صحيحا في حالة المنطقة الاستوائية – كانت هناك ٦ سنوات متتالية من الجفاف بين عامي ٧٨٠ – ٧٨٥ م

وحدثت خمس سنوات جفاف خلال الاعوام ٧٦٣/ ٧٦٥/ ٧٦٩/ ٧٧١/ ٧٥٥ وخلال نفس الفترة تقريبا هطلت أمطار غزيرة على الحبشة أي أنه الجفاف عم المنطقة الاستوائية خلال الفترة ٧٦٣ – ٧٨٥ وهذا يتزامن مع الانخفاض الحاد الذي ظهر في المنحني التنعيم ب ٧٩ سـنة للميـاه الاستوائية كما يتزامن مع القمة في المنحني المشابه للمياه الأثيوبية (شكل ٩) ٠

وهذا وقد سجلت سنوات ثنائية للجفاف في المنطقـة الاسـتوائية (١٢٠١و ١٢٠٢) (١٢٣١و ١٢٣٢) و (١٤٠٤ ، ١٤٠٥) كما سجلت ٧ أعوام فردية للجفاف في نفس المنطقة٠

وفى خلال السنوات ١١٠٠ – ١١٣٤ من فترة النشاط الشمس خلال العصور الوسـطى تعرضت المنطقة الاستوائية لأمطار غزيرة خلال أعوام ١١٠٠ و ٦ سنوات متتاليـة بـين ١١٠٢ و ١١٠٨) و ١١١٢ إلى ١١١٤ و ١١١٦ إلى ١١١٨ و ١١٢٠ إلى ١١٢١ و ٩

بينما ساد الجفاف خلال هذه الفترة منطقة الحبشة خلال أعوام ١٠٨٥ و ١٠٦٩ ١٠٩٩ و ١١٠٠ و ١١٠٥ و ١١٠٧ و ١١٣ و ١١١٤ و ١١١٦و ١١٢٠ وثلاث سنوات من ١١٢٥ إلى ١١٢٧ و ١١٣١.

والخلاصة أنه أثيوبيا قد تعرضت للعديد من سنوات الجفاف خلال الفترة ١٠٦٣ إلى ١١٣١ خلال فترة الحضيض بين دورتا النيل الثانية والثالثة بينما سادت الأمطار الغزيرة الهضبة الاستوائية ففي خلال الأعوام ١١٤٨ إلى ١٢٧٨ اثنا عشر فيضانا وست أعوام جفاف فى المنطقة الاستوائية وعلى ذلك فإن النتائج تشير إلى انه خلال فترة النشاط الشمسى خلال العصور الوسطى ساد الجفاف الحبشة بينما ازدادت الأمطار على المنابع الاستوائية للنيل.

وعليه يمكننا القول أن خلال فترة ازدياد النشاط الشمسى فى العصور الوسطى فان الأمطار فى الحبشة تناسب تناسباً عكسياً مع النشاط الشمسى بينما تناسبت أمطار هضبة السحيرات تناسباً طردياً مع النشاط الشمسى.

وفى خلال السنوات المعروفة باسم **Wolf Minimum** للنشاط الشمسى (١٢٨٢ – ١٣٤٢) كانت هناك سنوات أمطار أكثر من سنوات الجفاف فى كل من الحبشة والمنطقة الاستوائية.

وبداية من عام ١٤٠٠ إلى ١٤٣٩ عادت الأمطار الغزيرة فسادت الحبشة – فكانت السنوات من (١٤٠٤ إلى ١٤٠٩) سنوات أمطار هائلة وكذلك سنوات (١٤٢٠ إلى ١٤٢٢ و ١٤٢٦ إلى ١٤٢٩) ثم عام ١٤٣٩.

وانه من الملاحظ عامة أن هلال الفترة ١٣٦٠ إلى ١٤٦٥ التى تتضمن الفترة المعروفة باسم **Sporer Minimum**كان هناك تبادلاً بين الأمطار الغزيرة والجفاف فى كل من منطقتى الحبشة والمنطقة الاستوائية.

ففى الفترة ١٣٦٠ – ١٣٩٢ هطلت أمطار غزيرة على المنابع الاستوائية تلتها أمطار غزيرة على الحبشة من ١٤٠٠ – ١٤١٦ فأمطار عزيزةعلى الحبشة من ١٤٢٠ إلى ١٤٣٩ وأخيراً أمطار غزيرة على المنطقة الاستوائية بثين عامى ١٤٣٦ و ١٤٦٥ ز وقد أدت هذه الفترة من الأمطار المتلاحقة المتتابعة على منبعى النيل إلى حدوث فياضانات عارمة على مصر فى الفترة ١٣٨٢ – ١٤٥٧ وارتفع معها قاع النيل ارتفاعاً كبيراً . خلال الفترة **Sporer Minimum** حيث سلت ٢١ فياضات أكثر من ٢٠ ذراعاً عند الروضة خلال هذه الفترة وكان أشد الفياضات خلال فترة ٦٢٢ – إلى ١٤٦٧ هو فيضان عام ١٣٦٠.

ويمكن اعتبار الفترة ١٢٨٠ إلى ١٤٦٥ فترة انتقال وأمطار متبادلة فوق منبعى النيل.

١١ – الجفاف الحديث فى المنطقة الاثيوبية والمنطقة الاستوائية:

أعد سامى (١٩١٦) قائمة بأدنى وأعلى منسوبان للنيــل فى الفتــرة ١٨٤٧ و ١٩٠٣ م مقدران بالذراع وكما تم فى الجزء السابق فقد أعددنا قائمة بفترات الجفاف والأمطار الغزيرة عليــه منطقتى الحبشة والمنطقة الاستوائية خلال هذه الفترة وهى حبشة بالجدول رقم (٩) الذى يتضح منه أن أعوام ١٨٧٧ و ١٨٨٨ و ١٨٩٧ و ١٨٩٩ و ١٩٠٢ كانت أعوام جفاف فى الحبشة . وبالمقارنة مع فهى (١٩٨٩) اتفاق عامى ١٨٧٧ و ١٩٠٢ لم يدرجا فى قائمته (٩,٧٤ و ٩,١٤ ذراع) على الترتيب.

جدول (٨) القائمة بملوط وامتناع المطر فى المصادر الاثيوبية والاستوائية .

الاستوائى: امتناع المطر، السنوات	<٢ بالذراع	المطر الشديد	>٧ بالذراع	اثيوبيا: امتناع المطر	<١٠ ذراع	المطر الشديد	>١٥ ذراع
٦٢٦	١ر٧٩						
		٦٢٧	٨ر١				
		٦٣١	٧ر٥٤	٦٣١	٩ر٣٥		
				٦٣٣	٨ر١٣		
		٦٣٨	٨ر٨٦	٦٣٨	٧ر٣٥		
		٦٣٩	٧ر٦٤				
						٦٤٥	١٥ر١٣
				٦٤٦	٩ر٧٤		
				٦٥٠	٩ر٣٠		
		٦٦٠	٨ر٥٧	٦٦٠	(١٠ر١)		
		٦٦١	٨ر٥٧	٦٦١	٩ر٧٢		
		٦٦٣	٩ر١١	٦٦٣	٨ر١٠		
		٦٧٦	٧ر٢٥	٦٧٦	٨ر٨٣		
		٦٨١	٧ر٢١	٦٨١	٩ر٩٦		
						٦٨٣	١٥ر٠٤
		٦٨٦	٧ر٢٥	٦٨٦	٩ر٣٨		
				٦٨٧	٩ر٧٤		
		٦٩٢	٧ر٦٨	٦٩٢	٩ر٧٤		
		٦٩٤	[illegible]	٦٩٤	٩ر٤٥		
		٧٠٢	[illegible]	٧٠٢	٨ر٥٨		
				٧١٢	٧ر٢٥		
		٧١٩	٨ر٧١				
				٧٣٧	٩ر٧٥		
٧٤١	٢ر٠٠					٧٤١	١٦ر٥٤
						٧٤٢	١٥ر٠٣
				٧٥٢	٩ر٥٦		
						٧٦٠	١٥ر٣١
٧٦٣	١ر٥٧						
٧٦٥	١ر٧١					٧٧٠	١٥ر٣١
٧٦٩	١ر٧١						
٧٧١	١ر٥٧						
						٧٧٤	١٥ر١٩
٧٧٥	٢ر--					٧٧٥	١٥ر١١
						٧٧٧	١٥ر٨٨
٧٨٠	١ر٥						
٧٨١	١ر٥٧						
٧٨٢	١ر٣٦					٧٨٢	١٥ر٦٨
٧٨٣	٢ر--						
٧٨٤	١ر١٤						
٧٨٥	٢ر--					٧٨٥	١٥ر٦٣
				٧٥١	٩ر٧٥		
				٨١٣	٩ر٧٥		
		٨١٤	٨ر٦٤	٨١٤	٨ر٨٢		

الاستوائي	جفاف	الأمطار شديدة		جفاف	أثيوبيا	الأمطار شديدة	
				٨١٦	٩,٤٦		
				٨٣٩	٩,١٠		
		٨٥٢	٧,٠٠	٨٥٢	٩,٢٥		
				٨٥٩	٩,٣٤		
		٨٦٢	٨,٢٩	٨٦٢	٩,٥٠		
		٨٦٣	٩,٧١	٨٦٣	٧,٧٥		
		٨٦٤	٨,٥٤	٨٦٤	٩,٠٩		
		٨٦٥	٧,٥	٨٦٥	٩,٨٣		
		٨٧٨	٨,٤٣	٨٧٨	٩,٤٤		
				٨٩٥	٩,٤٩		
		٨٩٨	٧,٥٧	٨٩٨	٩,٢٢		
		٨٩٩	٧,٥٧	٨٩٩	٩,٧٩		
		٩٠٠	٧,٨٩	٩٠٠	٩,٥٣		
				٩٠٤	٦,٣٥		
		٩١٠	٩,٣٩	٩١٠	٧,٩٣		
		٩١١	٨,١٤	٩١١	٩,١٩		
				٩١٢	٧,٠٤		
				٩١٦	٩,٧٥		
				٩٢٧	٩,٩٢		
				٩٣٨	٩,٣٧		
						٩٤٢	١٥,٥
		٩٥٩	٧,٤٦				
		٩٦٠	٧,٦٨	٩٦٠	٩,٣٢		
				٩٦٢	٩,٩		
				٩٦٦	٩,٣٩		
				٩٦٧	٩,٧٥		
٩٦٨	١,٧١					٩٦٨	١٥,٧٩
٩٨١	١.-			١٠٠٥	٩,٠٣		
				١٠٠٧	٩,١٤		
١٠١٥	١,٧١					١٠١٢	١٥,٥

الاستوائي جفاف، الأمطار شديدة		جفاف أثيوبيا الأمطار شديدة	
١٠٢٠	٨,١٨	١٠٢٠	٩,٢٨
١٠٢٨	٧.-		
		١٠٣٦	٨,٦١
		١٠٤٥	٩,١
		١٠٦٣	٩,٩٧
		١٠٦٧	٨,٥٠
		١٠٦٩	٩,١٤
		١٠٧٩	٩,٦٨
		١٠٨٢	٦,٨٦
		١٠٨٥	٩,٥٧
		١٠٩٦	٩,٠٣
		١٠٩٩	٩,٧١
		١١٠٠	٧,٩٧
١١٠٠	١٠٥٧		
١١٠٢	٧,٢٩		
١١٠٣	٧,٢٩		
١١٠٥	٧,١٨	١١٠٥	٩,٢٥
١١٠٦	٨,٠٠		
١١٠٧	٨,٣٢	١١٠٧	٩,٣٢
١١٠٨	٧,١٨		
١١١٢	٧,١١		
١١١٣	٨,٥٤	١١١٣	٩,٥٣
١١١٤	٧,٥	١١١٤	٩,٥
١١١٦	٧,٦٨	١١١٦	٩,٢٣
١١١٧	٧,٤٣		
١١١٨	٧,٨٨		
١١٢٠	٩,٤٣	١١٢٠	٨,٦١
١١٢١	٧,١٤		
١١٢٣	٨,٢٩		
١١٢٤	٧,٧١		
١١٢٥	٩,١١	١١٢٥	٩,٣٩

الاستوائي جفاف		الأمطار شديدة		جفاف أثيوبيا		الأمطار شديدة	
		١١٢٦	٨,١١	١١٢٦	٩,٩٣		
		١١٢٧	٨,٦١	١١٢٧	٨,٣٩		
		١١٢٨	٧,٢٩				
		١١٢٩	٧,٩٣				
		١١٣٠	٧,١٤				
		١١٣١	٧,٠٧	١١٣١	٩,٥		
		١١٣٤	٧,٥٤				
		١١٤٨	٧,٢٩				
١١٥٧	١,٧١						
				١١٥٩	٧,٤		
		١١٦٤	٨,٢٩				
		١١٧١	٧.-				
		١١٧٥	٧,٧٥	١١٧٥	٨,٦١		
		١١٨٥	٧,٦٨	١١٨٥	٩,٧٢		
						١١٩٣	١٧,١٨
١١٩٣	١,١١						
				١٢٠٠	٩,٨٢		
١٢٠١	٢..-						
١٢٠٢	١٠.-	١٢٠٦	٧,٥	١٢٠٦	٩,٦٧		
				١٢١٠	٩,٨٣		
				١٢١١	٦,٤		
١٢٣١	٢.-						
١٢٣٢	١,٠٢			١٢٣٢	١٥,٩		
		١٢٣٨	٧.-	١٢٣٨	٩,٣٩		
		١٢٦٥	٧,٠٧				
				١٢٧٠	٩,٧٨		
		١٢٧٢	٧,٠٧				
		١٢٧٣	٧,٣٩				
		١٢٧٨	٧,٧١				
						١٢٨٠	١٥,٦٤
		١٢٩٢	٧,٥٧	١٢٩٢	٩,٤٣		

الاستوائي جفاف	الأمطار شديدة			جفاف	أثيوبيا	الأمطار شديدة	
١٢٩٥	١,٢٥					١٢٩٥	١٥,٣٦
						١٣١٠	١٥,٣٥
		١٣٢٦	٨,٣٦	١٣٢٦	٨,٣٢		
						١٣٢٤	١٦,٤٦
		١٣٦٠	١٢,٠٠				
		١٣٧٢	٧,٨٩	١٣٧٢	٩,٠٢		
		١٣٨٣	٨.–				
		١٣٨٣	٨,٢٩				
		١٣٩٢	٧,٧١				
١٤٠٤	١,٣٦						
١٤٠٥	٢.–					١٤٠٠	١٦,٤٣
						١٤٠٤	١٧,٧٥
						١٤٠٥	١٦,٨٢
						١٤٠٦	١٧.–
						١٤٠٧	١٥,٨٦
						١٤٠٨	١٥.–
١٤١٠	٧,–						
١٤١٤	٧,–			١٤١٢			١٥,٦٤
١٤١٦	٧,٥						
١٤١٦	٧,٥			١٤٢٠			١٥,١١
				١٤٢١			١٥,٢١
				١٤٢٢			١٥,٣٢
١٤٢٣	٨,٣٦						
				١٤٢٦			١٥,٨٢
				١٤٢٧			١٥,٨٢
				١٤٢٨			١٦,٥٧
				١٤٢٩			١٥,٢٥
١٤٣٦	١١,٣٦	١٤٣٦	٧,٨٥				
				١٤٣٩			١٦,٠٣
١٤٤١	١٠,٥٤						
١٤٤٧	١١,٤٣	١٤٤٧	٨,٠٧				

الاستوائي جفاف	الأمطار شديدة	جفاف	أثيوبيا	الأمطار شديدة
١٤٥٣	٨,١٧			
١٤٥٤	٧,٥٤			
١٤٥٥	٧,١٨			
١٤٥٦	٧,٥٧			
١٤٥٧	٧,٢١			
١٤٥٨	٧,٢١			
١٤٦٢	٦,٣٦			
١٤٦٣	٧,٧١			
١٤٦٣	٧,٧١			
١٤٦٥	٧,-			
١٤٦٦	٧,٢			

جدول (٩) القائمة بالجفاف والامطار الغزيرة فى مصادر الاثيوبية والاستوائية

جفاف السنين <٣ سنين	الامطار الغديدة > ٧	جفاف السنين < ١٠سنين	الامطار الغديدة > ١٥
			١٨٤٨ - ١٢٨٥١ > ١٦ر٤٤
	١٨٥٥ ٧ر٤٣		١٨٥٣ - ١٨٥٦ > ١٦ر٩
	١٨٥٧ ٧ر٥		
			١٨٥٨ - ١٨٦١ > ١٥ر١٨
	١٨٦١ ١٨٧٧ > ٧		
			١٨٦٣ ١٦ر٩٧
			١٨٦٥ - ١٨٦٦ > ١٥ر٥٧
			١٨٦٩ - ١٨٧٢ > ١٦ر١٣
			١٨٧٤ - ١٨٧٦ > ١٦ر٧٤
	١٨٧٧- ٩ر٧٤		
			١٨٧٨ ٢٠ر٤٦
	١٨٧٩ -ر١٠		
	١٨٨٠- ١٨٨٢ > ٧		١٨٨١ ١٦ر٨٦
			١٨٨٣ ١٧ر٢٥
			١٨٨٧ ١٦ر٨٧
١٨٨٤ - ١٨٩٨		١٨٨٨ ١٠ر٤٧	
			١٨٩٢ ١٦ر٥١
			١٨٩٣ ١٦ر٥١
			١٨٩٤ ١٥ر٦٦
		١٨٩٧ ١٠ر٤	
	١٨٩٩ -ر١٠	١٨٩٩ -ر٦	
	١٩٠٠ - ١٩٠٣	١٩٠٢ ٩ر١٤	

أظهرت الدراسة المستفيضة لبيانات نهر النيل أن مستويات الفيضان كات منخفضة خـــلال الفترة ٦٥٠ – ١٠٦٥ ميلادية ومتوسطة خلال الفترة ١٠٦٥ إلى ١١٩٨ – بينما كانت عالية جداً فى خلال الفترة ١٣٢٨ إلى ١٤١٢ ميلادية.

وقد اظهرت نتائج فترة البيانات بفلتر متحرك قدره ٩٠ عاماً أن النهاية الصغرى لمســاهمة هضبة الحبشة والنسبة (**Ratio**) يمكن فصلها إلى ثلاث مركبات منفصلة تماماً لكل فيهم دورتــه . ويأثر بتغيرات متماثلة.

وهذه المركبات هى:

أ- الدورة الشميسة (١) : ٦٥٠ إلى ٨٨٥

ب- الدورة الشمسية (٢) : ٨٨٦ إلى ١١٠٧

ج – الدورة الشمسية (٣) : ١١٠٨ إلى ١٣١٠

وقد اظهرت التائج أبيضا دورة قوية عند ٢٦٥,٩٩ عاماً ومضاعفاها مما يشير إلى أصـــلها الشمس بالإضافة إلى الدورة ٨٠ عاماً فى ماء النيل . كذلك فان دورة ٢٢ عاماً تظهر تأثير الـــدورة المغناطيسية للمشس على سقوط الأمطار.

كذك أظهرت نتائج المقارنة ، فى الفترة ١٨٢٥ إلى ١٩٠٢ ، بين المعامل العـــددى للبقـــع الشميسة ومياه هضبة الحبشة أن هناك علاقة موجبة مع دورة ١١ سنة – بعكس مياه الهضبة الحبشة أن هناك علاقة موجبة مع دورة ١١ سنة – بعكس مياه الهضبة الاستوائية التى اظهرت علاقة ســالبة بينما تنعكس العلاقة خلال الفترة ١٨٧٠ – ١٩٧٣.

كذلك اظهرت دراسات الجفاف سقوط الأمطار غزيرة فى الفترة ٦٢٢ – ١٤٦٧ خـــلال **Medieval maxima** وفى خلال هذه افترة فان كمية الأمطار الساقطة وجدت الها تتناســب سلبياً مع النشاط الشمسى فى الحبشة بينما تتناسب فى المنطقة الاستوائية طردياً، وتغير فتـــرة النهايـــة الصغرى **sporeer mininun** فترة تغيرات ذات أمطار غزرة على كلا المنطقتين .

ويعتبر ظهور الدورة القوية ١٩ سنة نتيجة هامة وخاصة فى العصر الحديث وأيضاً فى ميـــاه المنطقة الاستوائية للدورتين ١ ، ٢ (٦٥٥ إلى ١١٠٧) وهذه الدورة تعتبر نتيجة للـــدروة القمريـــة العقدية ١٨,٦ عاماً – حيث تظهر تأثير هذه الدورة على مصدرى النيل – وتاثيرها علـــى امصـــدر الاستوائى فى الفترة ٦٦٥ – ١١٠٧ ز ويجب الأشارة إلى أن سامى (١٩١٦) قد أشار إلى أن الفترة

بين الفيضانات المنخفضة والفيضات العالى هى ١٩ عاما أو مضاعفاتها كذلك امكن النقاط الدورة ١٨,٦ عاماً فى حلقات الأشجار.

وتعتبر قوى المد والجزر ذات أهمية فى تكون anticyclone وفى تعتبر خواص التحركات الجوية وتظهر مناطق الجفاف فى مناطق anticyclones بينما يتزايد سقوط الأمطار حولها . ويكون عرض منطقة تأثير المد والجزر فى حدود ٣٠٠ – ٥٠٠ كم فى خطوط الطول.

وفى خلال السنوات الحديثة لفتت ظاهرة El – Nino إلى تأثيرها على نهر النيل (ظــاهرة النينو هى ظاهرة حدوث زيادة فى درجات حرارة الماء السطحى فى المنطقة الاستوائية الغربية من المحيط الباسفيكى حتى حدود بيرو – (وهى تغير فى الضغط الجوى فوق المحيط الهندى بعلاقة مخافلة فى الطور حيث وجد أن السنوات التى تظهر فيها ظاهرة ENSO يكون الفيضان أقل من المتوسط فى النيــل الأزرق ونهر عطبرة . وحيث أنه أمكننا جدولة سنوات الجفاف فى أثيوبيا بين ٦٢٢ – ١٤٦٧ – فإن هذه السنوات تعتبر سنوات ظهور ENSO .

وقد قام (Arrigoand Jacoby, 1991) بجدولة ١٠٠٠ عام من ٩٨٥ إلى ١٩٧٠ من أمطار الشتاء خلال تحليل حلقات الأشجار فى المنطقة الشمالية الغربية لولاية نيو مكسيكو وهــى منطقة معروفة بعلاقتها بظاهرة ENSO – حي تظهر الظروف الممطرة فى سنوات حدوث ظــاهرة ENSO.

وقد وجد أيضا أن هناك علاقة عكسية بين المصدر الاستوائى والمصدر الاثيوبى لمياه النيــل حيث تمثل علاقة:

ETAIOPIA = ETHIOPIA – M EQVATORIAL
RATIO = ETHIOPIA / EQVATORIAL = EQVATORIAL)

ويمثل متوسط الاسهام الاثيوبى حوالى ٧٤% بينما يتغير من ٤١% إلى ٩٤% – يمكن استخدام هذه النسبة المتغيرة فى الاتفاقيات الدولية بين مصر وأثيوبيا ويعتبر التوازن من اسهامات مصادر النيــل وعلاقاتها العكسية مع النشاط الشمس فضل من الله ونعمة فاذا حدوث خلاف هذا كان مصــدرى النيل متوافقات مع النشاط الشمس – فانه عند حدوث نهاية عظمى للمعامل العددى للبقع الشمسية – فانه عند النهاية العظمى للبقع الشمسية تحدث فيضانات شديدة وعند النهايــة الصــغرى للبقــع الشمسية يحدث جفاف شديد.

"انزلنا من السماء ماء بقدر فأسكنه فى الأرض وإنا على ذهاب به لقادرون" (سورة المؤمنون ١٨).

تذييل:

العلاقة بقين ارتفاع مستوى النيل عند مقياس الروضة بالذراع والمتر والتصرف بالمليون متر مكعب.

الجدوال المتاحة لبيانات فيضان النيل والسمتوى الأدنى تم تدوينها بالذراع والأصبع سـامى ١٩١٦) ١٨٧١ - ١٩١٤ بالمتر والذراع معاً عند الروضة والتصرف عند أسوان بـالمليون متـر مكعب (Hurst et al 1951) فى هذا التذييل نعطى معادلات الاستنباط وقد وجدنا أنا المعادلات الخطية تعطى خطأ أكبر من المعادلات الأسية.

١- العلاقة بين التصرف الأعظم بالمليون متر المكعب عند خزان أسوان والنهاية العظمى والمستوى النيل لها عند مقياس الروضة.

أ- التصرف الأعظم _١٠ متر مكعب) ٠,٦٦٦١٩ لها (بـالمتر ٣,٥٧) معامـل التوافق = ٠,٩٣ الخطا القياسى = ٠,٠٧٣

ب- التصرف الأعظم (١٠ متر مكعب) = ٢١٤,٨٠٤ لها (بالذراع)

أى التصرف الأعظم (١٠ متر مكعب) ٢١٤,٨ لها (بالذراع) معامل التوافـق = ٠,٩٤٩ الخطأ القياسى = ٠,٠٦٣ .

٢- العلاقة بين التصرف السنوى الطلى للنيل والنهاية العظمى للفيضان بعـد خـزان أسوان.

التصرف الكلى السنوى (١٠ متر مكعب) = ٤٠٣٩,١ + ٣,٨٨٦ X النهاية العظمـى للتصرف (٦١٠ متر مكعب).

معامل التوافق = ٠,٩٠٦ الخطأ القياسى = ٧٩٢٣,٤٤

٣- العلاقة بين التصرف السنوى الكلى بعد خزان أسوان والنهاية العظمـى لمسـتوى الفيضان عند مقياس الروضة.

التصرف السوى الكلى (١٠ متر مكعب) = ٩٦٠,٠٨٣ لها (بالذراع).

أو التصرف السنوى الكلى (١٠ متر مكعب) ٩٦٠ لها (بالـذراع) معامـل التوافـق = ٠,٨٥٧ الخطأ القياسى = ٠,١١٢.

هذه المعادلات تنطبق على جميع بيانات النيل . ولكن هناك بعض التعديلات لقيمة ارتفاع نتيجة لارتفاع قاع النهر وتغير مستوى صغر مقياس النيل والبيانات التالية لقياسات التالية لقياسات popper , 1951 - لمستوى قاع النيل الموجـودة بكتـات (سـعيد , ١٩٩٣).

حوالى ٨ سم /قرن فى خلال الفترة ١٦٤١ - ١٣٣٠ ميلادية

حوالى ٥٦ سم / قرن فى خلال الفترة ١٣٣٠ - ١٦٣٠ ميلادية

حوالى ٧,١١ سم / قرن فى خلال الفترة ١٣٦٠ - ١٨٤١ ميلادية

حوالى ٦٨ سم / قرن فى خلال الفترة القرن ١٩.

وتبعاً (سعيد ١٩٩٣) فان مستوى قاع المقياس هو متر فوق سطح البحر ، بينما كان قـاع النهر فى عام ٦٤١ هو (٥,٨ متر) ، وفى عام ١٨٤١ كان (٣,١) نتيجة ارتفاع قاع النهر . أى أن قاع النهر كان ٢,٧ متراً أقل فى عام ٦٤١ عنه فى عام ١٨٤١

وقد استخدمت ثلاث مقاييس منذ عام ٦٤١ – وتم عمل التعديلات الآتية

السنة	نقطة الصفر متر	طول الذراع < ١٢	طول الذراع > ١٢
٦٤١	٨,١٥	٥٣,٩ سم	٤٦,٢
١٥٢٢	٩,٧٧	٥٤,١	٣٦,١
١٨٤١	٨,٨١	انظر (سامى ، ١٩١٦ ٨٧ وقياسات الفلكى	

وبهذا يكون مستوى الصفر عام ٦٤١ أقل بمقدار ٠,٦٦ كتراً عن مستوى ١٨٤١ . وبذا يكون التصحيح بمقدار حوالى (٢٠٧ – ٠,٦٦متر) أى يجب إضافة أن يؤخذ ارتفاع قاع النيل فى الاعتبار تبعاً للقيم المذكورة عالية..

IV) REFERENCES

Allen,C.W. 1973.Astrophysical Quantities.Third edition. William Clowes & Sons, limited, London Beccles and Colchester.

Arrigo,D.D. and Jacoby Gordon C. 1991.Helocene 1 (2) 95.

Attia B.B.and Abulhoda A. 1989 .International Seminars Climatic Fluctuations and Water management.11-14 Dec 1989 Cairo Egypt.Paper I.4

Awaad.M.,1948.The river Nile Cairo. Egypt.

Currie. Robert G. 1991.International Journal of Climatology 11.8

Degfu.Workineh 1987.Droughts and Hunger in Africa. Ed. Michael H. Glatntz.

Fahmy,Ahmed,1994 .Private communications.

Fahmy S.H., 1989. international seminar on climatic and water management, 11-14 Dec , Cairo .Egypt.Paper III .20.

Hassan,Fekri 1981.Science 212,1142.

Herman, J.R.and Goldberg, R.A.1978.Sun ,Weather and Climate.Dover Publications,Inc. New York.

Hurst,H.E., Black R.P. and Simaika Y.M. 1951. The Nile Basin ,Vol VII Ministry of Public Works ,Egypt.

Hurst, H.E.,Black R.P. and Simaika Y.M. 1968. The Nile Basin, Vol X.Ministry of irrigation,Egypt.

Khaleel, N.M 1990.:Ph.D. Thesis Cairo University under preparation.

Kocharov G.E.1990. Methods of Dendchronology. E.R.Cook and L.A.Kairiukstis (eds) , 289.

LaMarche,Jr.,V.C., Holmes ,R.L. , Dunwiddie P.W. and Drew,L.G. 1979. Laboratory of Tree ring Research.University of Arizona.

Mabarek,Ismail E.,Halim,Mohamed and Dorrah,Hassan (1977)The River Nile Project,Stochastic modeling of Nile inflows to lake Nasser.Cairo university,M.I.T.,Technological planning program.

Negm,A.M.,Attia, B.P and Owais,T.M.1989. International Seminar on Climatic Fluctuations and water management. Cairo Egypt.(Paper I 8)

Popper(1951): The Cairo Nilometer. California University Press.

Said,Rushdi(1993). The River Nile (In Arabic).Dar El Hillal.

Sami,A.1916. The Nile Calender.Egyptian Government Publications.

Shaltoot,H.A. and Tadros,H.T.Y.,1989. Mausam, 393

Statgraphics 1986. Users Guide

Toussoun ,Prince Omar,1925.Memoire sur les Anciennes Branches Du Nil.Epoque Arab.Mem .Inst.Egypte.

Ward,Roy.1978.Floods.A geographical perspective .Focal Problems in Geography Series,The Macmillan Press LTD.London and Basing stoke.

Yousef, Shahinaz Mustafa,.1993 Bulletin of the Faculty of Science of Cairo university.

أبراج التبريد الطبيعي أسس التصميم و تقييم الأداء المتوقع في " توشكي"

أ.د فوزية إبراهيم مرسى [1]   د.م/ حمدي صادق احمد [2] م/ يحيى حسن وزيري [3]

١. قسم الموارد الطبيعية – معهد الدراسات والبحوث الأفريقية– جامعة القاهرة
٢. قسم العمارة – كلية الهندسة بالمطرية– جامعة حلوان
٣. مهندس استشاري – دبلوم وماجستير في الموارد الطبيعية

١– المقدمة والهدف من البحث:

ساهمت عدة أسباب في تزايد الاهتمام بحراسة و تطوير أنظمة التبريد الطبيعية في المباني أهمها ارتفاع تكاليف استهلاك الطاقة الكهربائية نتيجة لاستخدام مكيفات الهواء خاصة في أيام الصيف الحارة، إلى جانب تفاقم العديد من المشكلات البيئية الناتجة عن هذا الاستخدام والتي تساهم بقدر كبير في ارتفاع درجة حرارة الجو بالمدن (ظاهرة الجزر الحرارية) و تزايد مشكلة " ثقب الأوزون " بالغلاف الجوى.

و من أهم العناصر المعمارية التقليدية التي استخدمت في مناطق واسعة من البيئات الحارة الجافة لتحقيق قدر مناسب من التهوية و التبريد بالمباني هي أبراج التبريد الطبيعي أو ما يسمى تقليديا بملاقف الهواء أو "البادجير" وهى كلمة فارسية تعنى برج الهواء أو ملقف الهواء(٧)، حيث تعتمد في أدائها على استخدام الرياح و الماء لتهوية وتبريد المباني باستخدام أسلوب التبريد بالتبخير **Evaporative cooling** .

تتفوق أبراج التبريد (التهوية) عن غيرها من الفتحات و النوافذ بمميزات متعددة وهي (٦):

١. الحصول على هواء نقى نسبيا من الأتربة و ذلك لبعد مصدر الهواء عن سطح الأرض.
٢. الحصول على هواء بسرعة أعلى و ذلك لأن سرعة الهواء تتزايد كلما زاد الارتفاع عن سطح الأرض.
٣. الارتفاع و البعد عن المباني و العوائق المادية التي تحجب أو تعيق الرياح من الوصول إلى الفتحات.
٤. توفير التهوية للمباني أو الفراغات التي لا يوجد لها نوافذ خارجية.
٥. تلطيف درجة حرارة الهواء المار خلال جسم البرج.
٦. اقتناص نسيم الهواء من كافة الاتجاهات (كما في حالة البرج المربع) بصرف النظر عن توجيه المبنى .

ونظرا إلى أن الظروف المناخية في منطقة " توشكي " (خط عرض ٤٠. ٢٢ شمالا) تتسم بالحرارة و الجفاف الشديدين، حيث أن فترة سطوع الشمس تصل إلى ١٣ ساعة يوميا كما أن فرق درجة الحرارة بين الليل و النهار عال جدا يصل إلى ١٧ م مع تأثرها بكتل هوائية حارة في الصيف و قلة الرطوبة [١]، و هي ظروف مثالية لاستخدام أبراج التبريد الطبيعي في هذه المنطقة، فان هذا البحث يهدف إلى تقييم الأداء الحراري المتوقع لأبراج التبريد الطبيعي تحت الظروف المناخية السائدة في توشكي" من خلال دراسة تحليلية للعوامل المؤثرة على تصميم كل من أبراج التبريد المربعة و الأسطوانية للاستفادة منها في تهيئة مناخ جيد و مريح من الناحية الحرارية داخل المباني التي سوف تقام في هذه المنطقة.

٢- الأبحاث والتجارب الحديثة التي أجريت على أبراج التبريد:

قام بعض الباحثين بأبحاث و تجارب عديدة لتطوير أبراج الرياح التقليدية و ذلك بغرض تبريد الهواء الداخل من الفتحات الموجودة في أعلى البرج بواسطة التبخير الناتج عن استخدام الماء و عندئذ تزيد كثافة الهواء فيندفع ذاتيا إلى أسفل البرج و من ثم إلى داخل المبنى.
و سوف نستعرض بإيجاز نوعين من هذه الأبحاث و التجارب: الأولى تم إجرائها على أبراج التبريد المربعة و التي تستخدم مواد يتم ترطيبها بالماء كالمواد السليلوزية و توضع رأسيا خلف الفتحات العلوية التي يدخل منها الهواء لجسم البرج، أما الثانية فتم إجرائها على الأبراج الأسطوانية و التي تستخدم أد شاش **Showers** أو رشاشات مائية**Sprinklers** .

٢- ١- أبراج التبريد المربعة:

من أهم الأبحاث التي أجريت على هذا النوع من الأبراج ما قام به الباحثان "كانجهام و سمبثون" **Cunningham and Thompson** لمدة يومين في شهر أغسطس عام ١٩٨٦ بمدينة " أريزونا " في أمريكا [٨]، حيث أوضحت القياسات أنه عند الساعة الرابعة بعد الظهر و صلت درجة حرارة الهواء المرطب الخارج من البرج (**Exit air**) إلى ٢٣١٩ م و ذلك عندما كانت درجة حرارة الهواء الخارجي ١٦ ٥ ٤ م و الرطوبة النسبية بالخارج ٨٦ ٢١ م%.
كما اعتمدت بعض الأبحاث على استخدام برامج الحاسب الآلي، و من أهم هذه الأبحاث ما قام به الباحث "عفيفى "**Afifi** لتحليل العوامل المؤثرة على أداء أبراج التبريد [٥].
و في دراسة حديثة قام بها الباحثان "آل سعود والحمدى" لمعرفة مدى فاعلية استخدام أبراج التبريد في تبريد جامع" الرحمانية " و الذي يقع بمدينة "سكاكا " بمنطقة الجوف بشمال المملكة العربية السعودية (خط عرض ٥٠. ٢٩ شمالا) [٢]، أوضحت القياسات أن متوسط الانخفاض في درجات الحرارة الساعة الثانية ظهرا قد بلغ ١٤,٥ م.

٢- ٢- أبراج التبريد الأسطوانية:

تعتبر الأبحاث التي أجريت على أبراج التبريد الأسطوانية قليلة نسبيا، و من أهم هذه الأبحاث ما قام به الباحث "جيفونى" **Givoni** باستخدام الأدشاش المائية **Showers** [٩]، و بناء على هذه التجارب

تمكن من وضع معادلة حسابية يمكن عن طريقها حساب درجة حرارة الهواء المرطب الخارج من البرج(**Exit air**).

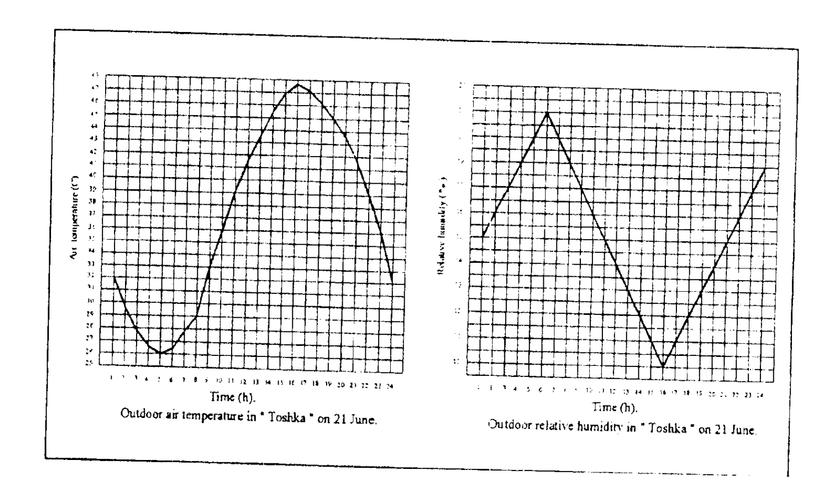
كما قام فريق بحثي (فوزية و أحمد و وزيري) [٤] بعمل تجارب حقلية لتطوير الأداء الحراري لملاقف هواء أسطوانية الشكل بأحد مباني جامعة حلوان خلال عدة أيام من شهر أغسطس عام ٢٠٠٠، و تم في هذه التجارب استحداث استخدام الرشاشات المائية **Sprinklers** بدلا من الأدشاش، و قد أوضحت القياسات إمكانية الوصول إلى انخفاض في درجة حرارة الهواء الخارج من البرج تصل إلى ٨,٦ م عندما كانت الرطوبة النسبية الخارجية حوالي ٥٢٧/٥

٣-المعلومات المناخية والمعادلات الرياضية المستخدمة:

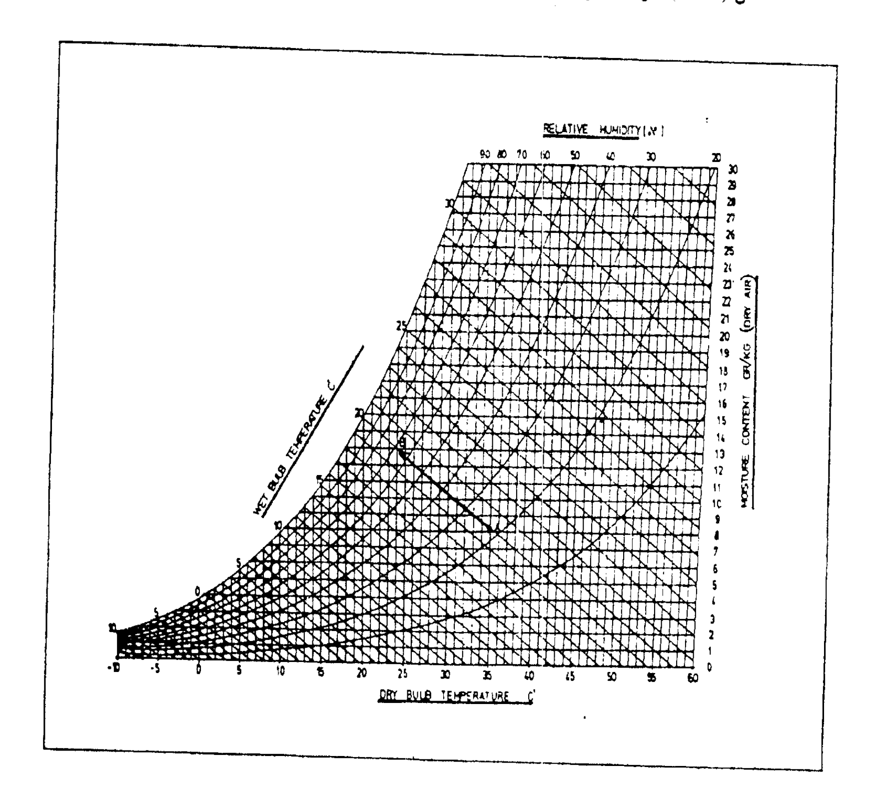
٣- ١- المعلومات المناخية لمنطقة توشكي:

يتضح من شكلي (١)، (٢) المعلومات المناخية الخاصة بمنطقة " توشكي "، حيث تم الحصول على درجات الحرارة و الرطوبة النسبية خلال يوم ٢١ يونية و الذي يمثل فترة الذروة الحرارية **Overheated period** خلال العام من جهاز تخطيط الطاقة [٣].

و باستعمال المعلومات المناخية السابقة يتم تحديد درجات الحرارة الرطبة. **Wet bulb temp** و ذلك باستخدام المنحنى البيومناخي (**Building Bio-climatic chart**)[٩]، أنظر شكل (٣).



شكل (١، ٢): لرجة الحرارة و الرطوبة النسبية الخارجية فى توشكي يوم ٢١ يونية



شكل (٣): المنحنى البيومناخي (Building Bio-climatic chart)

٣- ٢- المعادلات الرياضية المستخدمة:

٣- ٢- ١- المعادلات الخاصة بالبرج المربع:

بناء على يومين من التجارب و القياسات التي قام بها الباحثان (Cunningham &Thompson) على برج مربع المقطع وموضوع رأسيا حلف كل فتحة من فتحاته الأربع العلوية طبقةPad من المـــواد السليلوزية بسمك ١٠ سم يتم ترطيبها بالماء، و مساحة مقطع البرج من الداخل تساوى نصف مساحة المواد السليلوزية المرطبة كما يتم احتساب ارتفاع البرج من مستوى قاعدته السفلية و حـــتى منتصـــف ارتفاع هذه الطبقات الرأسية، أنظر شكل (٤)، فان درجة حرارة الهواء الخارج من البرج (Texit) يمكن الحصول عليها من المعادلة التالية [٩]:

$$Texit = DBT - 0.87 * (DBT - WBT);\ (°C) \quad \text{------------------------}(1)$$

Where:

*DBT = Dry Bulb Temperature °C

*WBT = Wet Bulb Temperature °C

كما يمكن حساب معدل تدفق الهواء (Flow) الخارج من البرج من المعادلة التالية [٧]:

$$Flow = 0.033 * Aevap * (H * (DBT - WBT)^{0.5};\ (m^3/s) \quad \text{-------}(2)$$

Where:

*Aevap = Area of the wetted pads; (m^2)

*H = Height of the tower; (m)

٣- ٢- ٢- المعادلات الخاصة بالبرج الأسطواني:

يتم حساب درجة حرارة الهواء الخارج من البرج(Texit) بمعلومة كل من ارتفاع الأد شاش الموجـــودة بداخله و معدل تدفق الماء الخارج منها كما يلي (٩):

$$Texit= DBT- (DBT-WBT)*(1-exp(-0.8*H)*(1-exp(-0.15*WF);(^0C\ )\text{-}(3)$$

*WF= Water flow rate: (liters I minute)

*H = Height of the shower; (m).

البرج الذي تمت عليه التجارب أسطواني الشكل و متوسط مساحة مقطعه حوالي ٣٦. م ٢،

و يتم احتساب الارتفاع من مستوى سطح الماء بالحوضPond الموجود في أسفل البرج و حتى مستوى رزوس الأدشاش Showers head ، أنظر شكل (٥).

٣- ٢-٣- حساب درجة الحرارة داخل المبنى:

يتم حساب درجة الحرارة داخل المبنى (Indoor air temp.(Tin والذي يستخدم الأبـــراج المربعة (أو الأسطوانية) من خلال المعادلة التالية [٩]:

$$T_{in} = (UA*Ta+2*0.33*Flow*Texit+Q)/(0.67*Flow+UA)\text{---}(4)$$

Where:

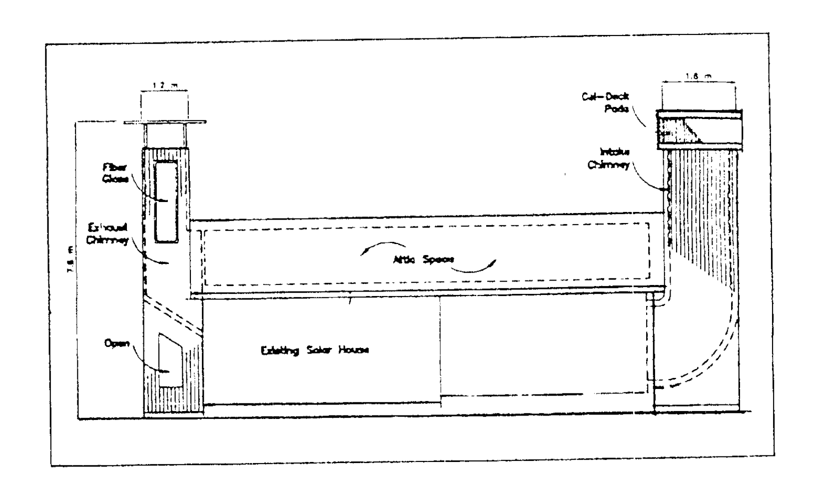
Ta = Outdoor air temperature, °C

Q = Internal and solar heat gain, watts(assumed as 500 watts)
0.33 Volumetric heat capacity of the air, Wh/ ^{0}C.m^3
UA = Hourly heat gain coefficient of the building, W/^{0}C.(The building loss coefficient (BLC)is assumed as 7000 Wh/^{0}C watt per hour which is related to traditional construction materials in Egypt (Afify, 1992) Where
UA = BLC/24

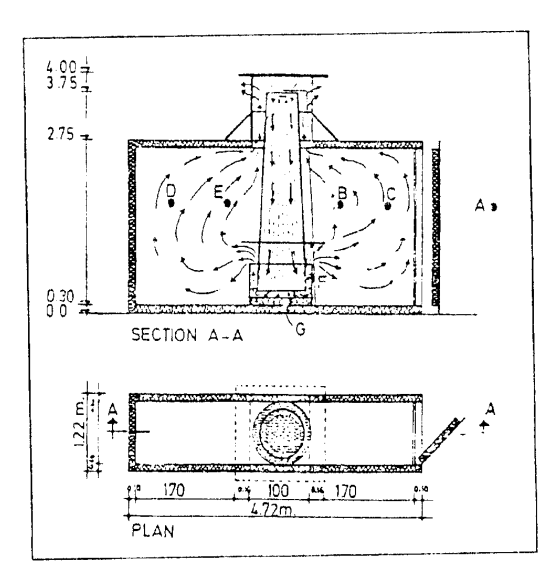
٣-٢-٤- حساب كفاءة أبراج التبريد:

يمكن حساب كفاءة أبراج التبريد المربعة أو الأسطوانية من المعادلة التالية [٢] :

Cooling efficiency = [(DBT – Texit) / (DBT – WBT)] * 100----(5)



شكل (٤): برج التبريد المربع من طراز (Cunningham &Thompson)



شكل (٥): برج التبريد الأسطواني من طراز (Shower cooling tower).

٤- تقييم الأداء الحراري المتوقع لأبراج التبريد الطبيعي في " توشكي " :

لتقييم الأداء الحراري المتوقع لكل من أبراج التبريد المربعة و الأسطوانية في" توشكي" من خلال تحليل العوامل المؤثرة على هذا الأداء، فقد تم استعمال المتوسطات ليوم ٢١ يونية على أساس أن متوسط درجة الحرارة الجافة (DBT) حوالي ٣٩°م و متوسط الرطوبة النسبية ١٤,٥% و متوسط درجة الحرارة الرطبة (WBT) ٢١°م.

٤-١- تحليل العوامل المؤثرة على أداء الأبراج المربعة:

لدراسة العوامل المؤثرة على أداء الأبراج المربعة من طراز (Cunningham and Thompson) فقد أخذ في الاعتبار أن يكون مسطح الترطيب Evaporative surface area المستخدم في البرج متغيرا (١، ٢، ٤، ٦ م٢)، و كذلك أن يكون ارتفاع البرج Tower heightمتغيرا أيضا (٢، ٤، ٦، ٨، ١٠ م) من أجل الوصول إلى أفضل تصميم للبرج من ناحية كفاءة التبريد.

٤- ١-١- تأثير تغيير مساحة مسطح الترطيب:

يتضح من تحليل النتائج الواردة بجدول (١) و شكل (٦) أنه كلما زادت مساحة مسطح الترطيب المستخدم في البرج فان درجة الحرارة داخل المبنى(Indoor air temp.(Tin تقل، كما أن معدل تدفق الهواء(Flow rate) داخل الفراغ يزداد باطراد.

و يمكن تحديد مدى تأثير زيادة مسطح الترطيب على انخفاض درجة الحرارة داخل المبنى (كمتوسط حسابي لجميع الارتفاعات المستخدمة) فيما يلي:

*بزيادة مسطح الترطيب من ١ إلى ٢ م٢ فان درجة الحرارة الداخلية تقل بحوالي ٢° م.

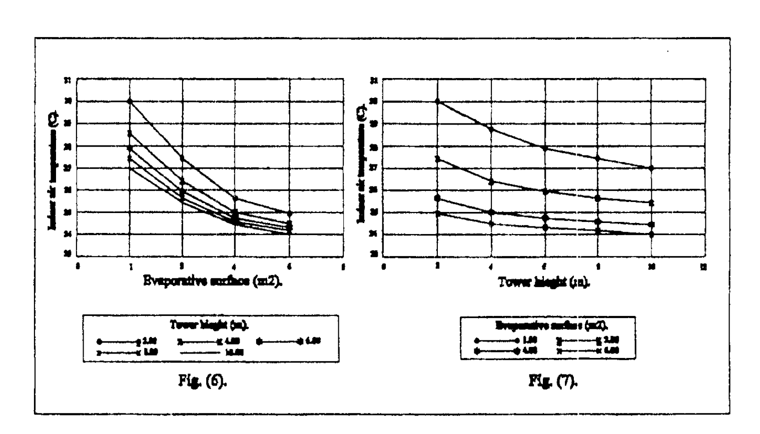
*بزيادة مسطح الترطيب من ٢ إلى ٤ م٢ فان درجة الحرارة الداخلية تقل بحوالي ١,٢٩° م.

*بزيادة مسطح الترطيب من ٤ إلى ٦ م٢ فان درجة الحرارة الداخلية تقل بحوالي ٠,٤٨ °م.

من ذلك يتضح أن استعمال مسطح ترطيب يزيد عن ٤ م٢ (في هذه الحالة تكون مساحة مقطع البرج ٢ م٢) لن يكون له تأثير ملموس على درجة الحرارة داخل المبنى خاصة إذا ما تم و ضع التكلفة الابتدائية Initial cost في الاعتبار. و لكن من الناحية العملية فإن هذا الإرتفاع لن يكون مناسبا للإستخدام في المباني حتى ذات الطابق الواحد (أي إرتفاعها ٣ م فقط)، لذلك فإنه يكون من المناسب عمليا أن يتم إستخدام برج تبريد مربع لا يزيد إرتفاعه عن ٦م بالنسبة للمباني ذات الطابق الواحد، إستخدام برج تبريد لا يزيد إرتفاعه عن ٨م بالنسبة للمباني ذات الطابقين.

جدول (١): تأثير تغيير مسطح الترطيب و الارتفاع للبرج المربع على درجة الحرارة داخل المبنى

Tower height (m)	Evaporative surface area (m^2)	Air flow rate (m^3/s)	Indoor air temperature (°C)
2.00	1.00	0.19	30.00
4.00	1.00	0.28	28.57
6.00	1.00	0.34	27.89
8.00	1.00	0.39	27.44
10.00	1.00	0.44	27.00
2.00	2.00	0.39	27.44
4.00	2.00	0.56	26.42
6.00	2.00	0.68	25.95
8.00	2.00	0.79	25.64
10.00	2.00	0.88	25.43
2.00	4.00	0.79	25.64
4.00	4.00	1.12	25.00
6.00	4.00	1.37	24.74
8.00	4.00	1.58	24.57
10.00	4.00	1.77	24.44
2.00	6.00	1.18	24.95
4.00	6.00	1.68	24.50
6.00	6.00	2.00	24.32
8.00	6.00	2.37	24.18
10.00	6.00	2.65	24.00



شكل (٦،٧): تأثير تغيير مسطح الترطيب والارتفاع للبرج المربع على درجة الحرارة داخل المبنى.

٤ - ١ - ٢ - تأثير تغيير ارتفاع البرج:

يتضح من تحليل النتائج الواردة بجدول (١) و شكل (٧) أنه كلما زاد ارتفاع البرج فان درجة الحرارة داخل المبنى

Indoor air temp. (Tin) تقل بصفة عامة.

و يمكن تحديد مدى تأثير زيادة ارتفاع البرج على انخفاض لحرجة الحرارة داخل المبنى (كمتوسط حسابي لجميع مسطحات الترطيب المستخدمة) فيما يلي:

* بزيادة الارتفاع من ٢ إلى ٤ م فان درجة الحرارة الداخلية تقل بحوالي ٠,٨٩ °م.
* بزيادة الارتفاع من ٤ إلى ٦ م فان درجة الحرارة الداخلية تقل بحوالي٠,٣٩ °م.
* بزيادة الارتفاع من ٦ إلى ٨م فان درجة الحرارة الداخلية تقل بحوالي٠,٢٦ °م.
* بزيادة الارتفاع من ٨ إلى ١٠م فان درجة الحرارة الداخلية تقل بحوالي ٠,٢٤ °م

من ذلك يتضح أن زيادة ارتفاع البرج عن ٤ م لن يكون له تأثير ملموس على درجة الحرارة د اخل المبنى خاصة إذا ما تم و ضع التكلفة الابتدائية **Initial cost** في الاعتبار، و لكن من الناحية العملية فان هذا الارتفاع لن يكون مناسبا للاستخدام في المباني حتى ذات الطابق الواحد (أي ارتفاعها ٣ م فقط)، لذلك فانه يكون من المناسب عمليا أن يتم استخدام برج تبريد مربع لا يزيد ارتفاعه عن ٦ م بالنسبة للمباني ذات الطابق الواحد، واستخدام برج تبريد لا يزيد ارتفاعه عن ٨م بالنسبة للمباني ذات الطابقين.

٤-٢- تحليل العوامل المؤثرة على أداء الأبراج الأسطوانية:

لدراسة العوامل المؤثرة على أداء الأبراج الأسطوانية من طراز **(Shower coohng towers)** فقد أخذ فى الاعتبار أن معدل تدفق الماء **Water flow rate** الخارج من الأدشاش داخل البرج متغيرا (١٠، ٢٠، ١٥، ٣٠ لتر/ دقيقة)، و كذلك أن يكون ارتفاع رؤوس الأدشاش **Showers headheight** متغيرا أيضا (٢، ٤، ٦، ٨، ١٠ م) من أجل الوصول إلى أفضل تصميم للبرج من ناحية كفاءة التبريد .

٤-٢-١- تأثير تغييرمعدل تدفق الماء:

يتضح من تحليل النتائج الواردة بجدول (٢) و شكل (٨) أنه كلما زاد معدل تدفق الماء الخارج من الأدشاش داخل البرج فان درجة حرارة الهواء المرطب الخارج من البرج **Exit air temp.** تقل، كما أن معدل تدفق الهواء **Flow rate** داخل الفراغ يزداد باطراد.

و يمكن تحديد مدى تأثير زيادة معدل تدفق الماء على انخفاض درجة حرارة الهواء الخارج من البرج (كمتوسط حسابي لجميع الارتفاعات للمستخدمة) فيما يلى:

* بزيادة معدل التدفق من ١٠ إلى ١٥ لتر/دقيقة فان درجة حرارة الهواء تقل بحوالي ٠,٩٥ ^{o}م.
* بزيادة معدل التدفق من ١٥ إلى ٢٠ لتر/دقيقة فان درجة حرارة الهواء تقل بحوالي ١ ^{o}م.
*بزيادة معدل المتدفق من ٢٠ إلى٢٥ لتر/دقيقة فان درجة حرارة الهواء تقل بحوالي ٠,٣٤ ^{o}م.

من ذلك يتضح أن استعمال معدل تدفق للماء يزيد عن٢٠ لتر/ دقيقة لن يكون لـــه تـــأثير ملموس على درجة الحرارة الهواء الخارج من البرج خاصة إذا ما تم و ضع التكلفة الابتدائية **Initial cost** في الاعتبار.

٤- ٢-٢- تأثير تغيير ارتفاع الأدشاش داخل البرج:

يتضح من تحليل النتائج الواردة بجدول (٢) و شكل (٩) أنه كلما زاد ارتفاع الأدشـــاش داخل البرج فان درجة حرارة الهواء المرطب الخارج من البرج**Exit air temp**. تقل بصفة عامة.

و يمكن تحديد مدى تأثير زيادة ارتفاع الأدشاش على انخفاض درجة حرارة الهواء الخارج من البرج (كمتوسط حسابي لجميع مسطحات الترطيب المستخدمة) فيما يلي:

* بزيادة الارتفاع من ٢ إلى ٤ م فان درجة حرارة الهواء تقل بحوالي ٢,٣٦ ^{o}م.
* بزيادة الارتفاع من ٤ إلى ٦ م فان درجة حرارة الهواء تقل بحوالي ٠,٦٩ ^{o}م.
* بزيادة الارتفاع من ٦ إلى ٨ م فان درجة حرارة الهواء تقل بحوالي ٠,١٠ ^{o}م.
* بزيادة الارتفاع من ٨ إلى١٠ م فان درجة حرارة الهواء تقل بحوالي ٠,٢ ^{o}م.

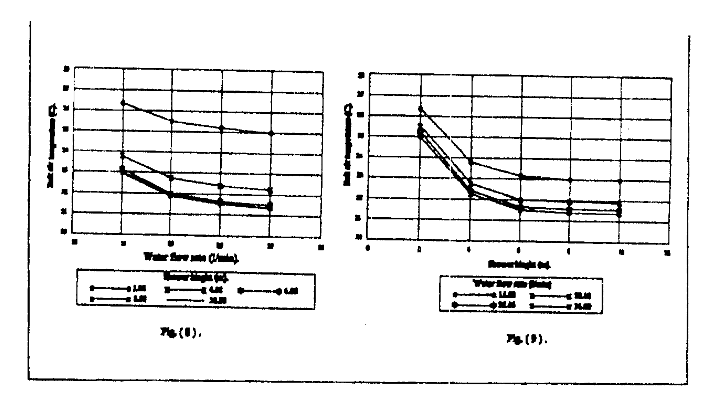
من ذلك يتضح أن زيادة ارتفاع الأدشاش عن ٤ م لن يكون له تأثير ملموس على درجة الحـــرارة داخل المبنى خاصة إذا ما تم و ضع التكلفة الابتدائية**Initial cost** في الاعتبار، لذلك فانه يكـــون من المناسب عمليا أن يتم استخدام برج تبريد أسطواني لا يزيد ارتفاعه عن ٦ م بالنسبة للمباني ذات الطابق الواحد، و استخدام برج تبريد لا يزيد ارتفاعه عن ٨م بالنسبة للمباني ذات الطابقين.

٤-٣- مقارنة الأداء الحراري لكل من الأبراج المربعة والأسطوانية :

تبعا للنتائج و التحليلات السابقة فقد تم اختيار برج تبريد مربع بارتفـــاع ٨م و بمســـطح ترطيب ٤ م^{2}، و برج تبريد أسطواني ارتفاع الأدشاش داخله ٨م و معدل تـــدفق المـــاء منـــها٢٠ لتر/دقيقة لإجراء مقارنة بينهما من وجهة نظر الأداء الحراري و كفاءة التبريد تحت الظروف المناخيـــة السائدة في" توشكي" (يوم ٢١ يونية).

جدول (٢) تغييرمعدل تدفق الماء و ارتفاع الأدشاش للبرج الأسطواني على درجة حرارة الهواء الخارج من البرج

Tower height (2m)	Water flow rate (1/min)	Air flow rate (m^3/s)	Exit air temperature (°C)
2.00	10.00	0.17	27.13
4.00	10.00	0.25	24.73
6.00	10.00	0.30	24.12
8.00	10.00	0.35	24.00
10.00	10.00	0.39	23.99
2.00	15.00	0.26	26.34
4.00	15.00	0.37	23.78
6.00	15.00	0.45	23.14
8.00	15.00	0.52	23.00
10.00	15.00	0.59	22. 99
2.00	20.00	0.35	25.49
4.00	20.00	0.50	22.75
6.00	20.00	0.61	22.00
8.00	20.00	0.70	21.93
10.00	20.00	0.79	21.91
2.00	25.00	0.44	25.20
4.00	25.00	0.62	22.41
6.00	25.00	0.76	21.65
8.00	25.00	0.88	21.57
10.00	25.00	0.98	21.55



شكل (٨، ٩) تأثير تغيير معدل تدفق الماء و ارتفاع الآدشاش داخل البرج الأسطواني على درجة حرارة الهواء الخارج من البرج.

ويلاحظ من النتائج الواردة في جدول (٣)، أنه بالنسبة للبرج المربع فإن درجات الحـــرارة داخل المبنى تقع في الحدود المسموح بها للراحة الحرارية ولكن بالنظر للرطوبة النسبية فنجد أنها تقـــع على الحدود العلوية (حوالي ٧٠%) لنطاق الراحة الحرارية **Comfort zone** تبعاً لمنحنى الراحة الحرارية [١٠]، أما بالنسبة للبرج الأسطواني فإن درجات حرارة الهواء الخارج منه تقع تقريباً في الحدود المسموح بها للراحة الحرارية ولكن بالنظر للرطوبة النسبية فنجد أنها عالية جداً (٩٠%) أي أن الهواء اقترب من درجة التشبع ، لذلك فيصبح من اللازم تقليل مساحة مسطح التبريد المستخدمة في البرج المربع وتقليل معدل الماء المستخدم في البرج الأسطواني من أجل الوصول لدرجة مقبولة من الرطوبـــة النسبية تقع داخل نطاق الراحة الحرارية .

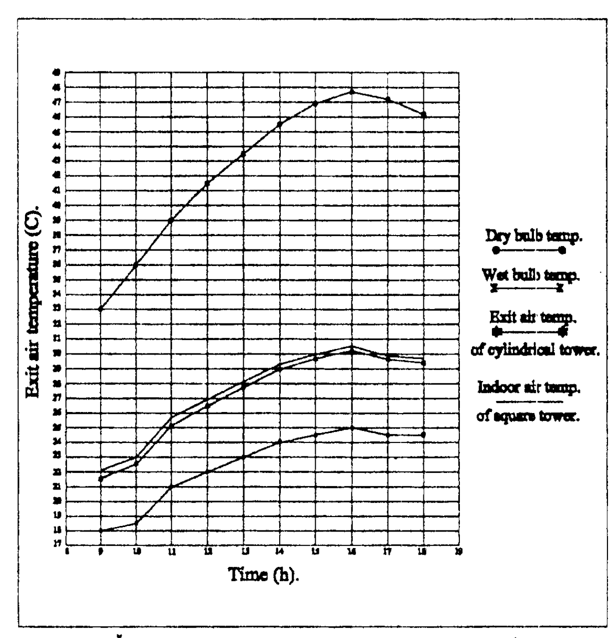
وبتقليل مسطح الترطيب في البرج المربع من ٤م^{٢} إلى ٢م^{٢} فإن الرطوبة النسبية تقل إلى درجة معقولة (٦٤% فى المتوسط) وتصبح فى نطاق الراحة الحرارية مع ارتفاع بسيط فى درجـــة الحـــرارة داخل المبنى ، وبتقليل معدل تدفق الماء فى البرج الأسطوانى من ٢٠لتر/دقيقة إلى ١٠ لتر/دقيقة فـــإن الرطوبة النسبية تقل إلى درجة معقولة (٦٥% فى المتوسط) وتصبح فى نطاق الراحة الحراريـــة مـــع ارتفاع بسيط فى درجة حرارة الهواء الخارج من البرج ، أنظر جدول (٤) وشكل (١٠) .

جدول (٣): مقارنة الأداء الحرارى بين برج تبريد مربع بمسطح ترطيب ٤م^{٢} وارتفاع ٨م وبرج تبريد أسطوانى ارتفاع الأدشاش داخله ٨م ومعدل تدفق الماء منها ٢٠ لتر / دقيقة (يوم ٢١ يونية) .

Results / Time	The Cunningham and Thompson cooling tower (8.00m height and evaporative surface area of $4.00m^2$)		The Shower cooling tower (8.00m shower height and water flow rate of 20 l/min.)		Wet bulb temperature (°C)
	Indoor air temperature (°C)	Relative humidity of exit air (%)	Exit air temperature (°C)	Relative humidity of exit air (%)	
9.00	21.10	72	18.77	90	18.00
10.00	21.98	72	19.40	90	18.50
11.00	24.57	72	21.93	90	21.00
12.00	25.81	72	23.00	90	22.00
13.00	26.96	72	24.00	90	23.00
14.00	28.12	72	25.11	90	24.00
15.00	28.77	72	25.66	90	24.50
16.00	29.31	72	26.17	90	25.00
17.00	28.81	72	25.67	90	24.50
18.00	28.66	72	25.62	90	24.50

جدول (٣): مقارنة الأداء الحرارى بين برج تبريد مربع بمسطح ترطيب ٢م٢ وارتفاع ٨م وبرج تبريد أسطوانى ارتفاع الأدشاش داخله ٨م ومعدل تدفق الماء منها ١٠ لتر/دقيقة (يوم ٢١ يونية) .

Results / Time	The Cunningham and Thompson cooling tower (8.00 m height and evaporative surface area of 2.00 m^2		The Shower cooling tower (8,00m shower height and water flow rate of 10 l/min.)		Dry bulb temperature (°C)
	Indoor temperature (°C)	Relative humidity of exit air (%)	Exit air temperature (°C)	Relative humidity of exit air (%)	
9.00	22.10	65	21.45	68	33.00
10.00	23.00	63	22.52	65	36.50
11.00	25.67	65	25.14	68	39.00
12.00	26.92	65	26.48	65	41.50
13.00	28.11	65	27.71	65	43.50
14.00	29.30	63	28.94	65	45.50
15.00	29.96	63	29.65	65	46.90
16.00	30.51	63	30.22	65	47.70
17.00	29.85	63	29.62	65	47.20
18.00	29.70	63	29.39	65	46.20



شكل (١٠): مقارنة الأداء الحرارى بين برج تبريد مربع بمسطح ترطيب ٢م٢ وارتفاع ٨م وبرج تبريد أسطوانى ارتفاع الأدشاش داخله ٨م ومعدل تدفق الماء منها ١٠ لتر/دقيقة (يوم ٢١ يونية) .

كما يلاحظ أيضاً أن متوسط الانخفاض اليومي (من الساعة ٩ صباحاً إلى الساعة ١٨ ظهراً) بين درجة حرارة الهواء الخارجي ودرجة حرارة الهواء داخل المبنى الذي يستعمل البرج المربع حوالي ١٥٠٢٠ °م بكفاءة تبريد تقدر بحوالي ٧٥% ، ومتوسط الانخفاض اليومي (من الساعة ٩ صباحاً إلى الساعة ١٨ ظهراً) بين درجة حرارة الهواء الخارجي ودرجة حرارة الهواء المرطب الخارج من البرج الأسطواني حوالي ١٥٠٥ °م بكفاءة تبريد تقدر بحوالي ٧٧%.

ونظراً إلى أن درجة حرارة الهواء المرطب الخارج من برج التبريد يحدث لها ارتفاع بسيط بعد دخولها إلى المبنى تتراوح ما بين ١ إلى٣ °م أي أن الزيادة في المتوسط تكون٢° م وذلك في حالة أي نظام للتبريد بالتبخير [٩] ، وبمقارنة الفرق بين درجات حرارة الهواء المرطب الخارج من الرج الأسطواني وبين درجة حرارة الهواء داخل المبنى الذي يستخدم البرج المربع في جدول (٤) ، فإننا نجد أن متوسط الفرق حوالى٠.٤٠ °م وهو ما يوضح أنه يوجد تقارب كبير في الأداء الحراري المتوقع لكل من البرجين السابقين ، أنظر شكل (١١) .

٥- النتائج والتوصيات :

يمكن إيجاز النتائج والتوصيات التي توصل إليها البحث فيما يلي :

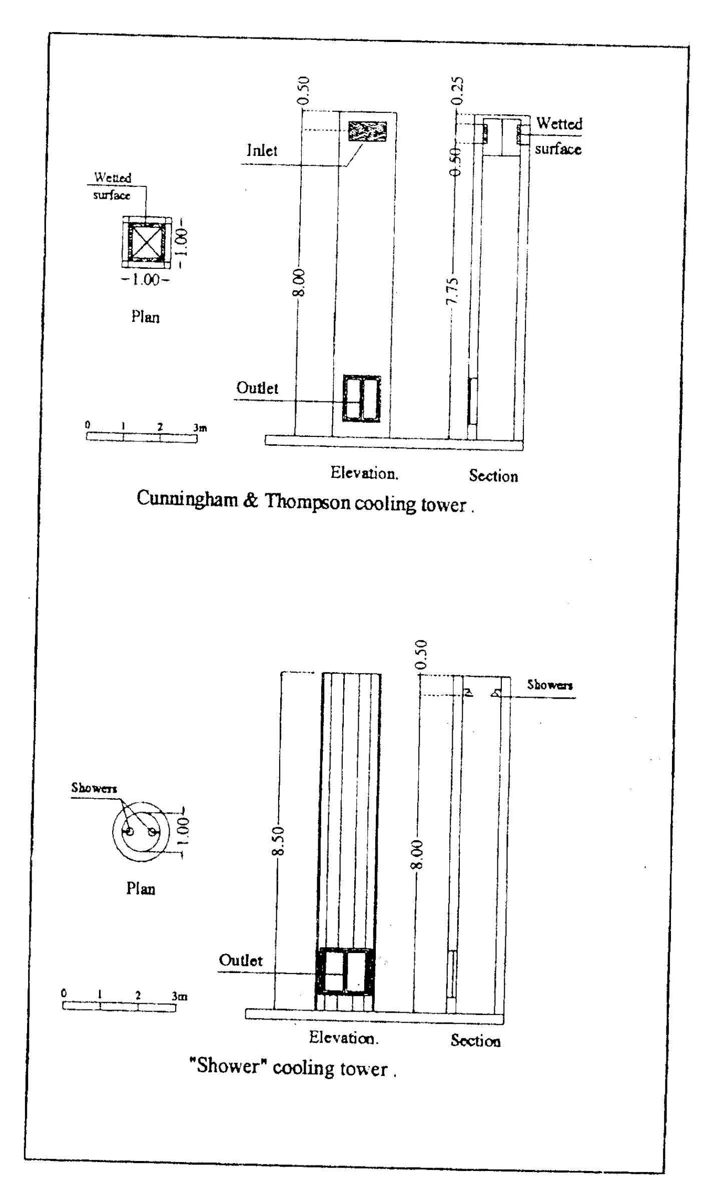
١-اتضح من تقييم الأداء الحراري المتوقع أن لكل من الأبراج المربعة والأسطوانية كفاءة كبيرة في تبريد المباني تصل في المتوسط لحوالي ٧٥% تحت الظروف المناخية شديدة الحرارة والجفاف في " توشكي " ، كما وصل متوسط الانخفاض اليومي ما بين درجة حرارة الهواء الخارجي والهواء المرطب الخارج من البرج الأسطواني لحوالي ١٥,٥٠ °م ، ووصل متوسط الانخفاض اليومي ما بين درجة حرارة الهواء الخارجي ودرجة حرارة الهواء داخل المبنى الذي يستعمل البرج المربع لحوالي ١٥,٢٠ °م .

٢-بالنسبة للأبراج المربعة فلا يوصى باستعمال مسطح للترطيب يزيد عن ٢م^{2} ، أما بالنسبة للأبراج الأسطوانية فلا يوصى باستعمال معدل تدفق الماء يزيد عن ١٠ لتر/دقيقة لتحقيق مستوى مقبول من درجات الحرارة والرطوبة النسبية في نطاق الراحة الحرارية داخل المبنى.

٣-بالنسبة لارتفاع الأبراج المربعة وارتفاع الأدشاش في الأبراج الأسطوانية فيوصى ألا يزيد الارتفاع في الحالتين عن ٦م في حالة المباني ذات الطابق الواحد وعن ٨م في حالة المباني ذات الطابقين .

٤-أوضحت المقارنة أنه يوجد تقارب إلى حد كبير بين الأداء الحراري لبرج التبريد المربع الذي ارتفاعه ٨م ويستخدم مسطح ترطيب ٢م^{2} مع برج التبريد الأسطواني الذي ارتفاع الأدشاش داخله ٨م ومعدل تدفق الماء منها ١٠ لتر/دقيقة .

٥-يوصى بإجراء تجارب وقياسات حقلية في منطقة " توشكي " على أبراج تبريد طبيعي ذات أحجام طبيعية وبنفس المواصفات التصميمية التي توصلت إليها الدراسة من أجل الوصول إلى نتائج أكثر دقة تحت الظرف المناخية السائدة في المنطقة .



شكل (١١) : يوجد تقارب كبير في الداء الحراري المتوقع لكل من برج التبريد المربع بمسطح ترطيب ٢م٢ وبارتفاع ٨م وبرج التبريد الأسطواني بمعدل تدفق ماء ١٠ لتر/دقيقة وارتفاع الأدشاش داخله ٨م .

(١) الخربوطلى ، عمرو على وعبد العاطى ، اشرف صبحى . (١٩٩٨) . توشكي بين الحلم والحقيقة . دار مكتبة الإسراء ، طنطا ، جمهورية مصر العربية .

(٢) آل سعود ، عبد الله بن مقرن والحمدى ، ناصر بن عبد الرحمن (١٩٩٩) . أبراج التبريد الطبيعي وآثرها على الأداء الحراري للمساجد ، سجل بحوث ندوة عمارة المساجد – المجلد السادس (التحكم البيىء في عمارة المساجد) ، كلية العمارة والتخطيط – جامعة الملك سعود ، الرياض .

(٣) جهاز تخطيط الطاقة (١٩٩٨) . مستندات مسابقة " العمارة الخضراء في توشكي " . القاهرة .

(٤) فوزية إبراهيم مرسى وأحمد ، حمدى صادق وزيرى ، يحيى حسن (٢٠٠٠) تطوير الأداء الحرارى لملاقف الهواء . مجلة البحوث الهندسية ، مجلد (٧١):ص ٢١٠ : ٢٢٤ ، كلية الهندسة المطرية بالقاهرة ، جامعة حلوان .

(5) Afifi, M.M. (1992). Passively integrated heating and cooling systems (M.Sc.) . Dept. of Arch.., Faculty of Engineering, Cairo Univ.

(6) Al-Megren, K. (1987). Wind towers for passive ventilation cooling in hot arid region. Doctoral Dissertation, MI: University of Michigan, ASA.

(7) Bahadori, M. (1985). An improved design of wind tower for natural ventilation and passive cooling. In: Solar Energy, VoI. 35, No.2.

(8) Cunningham, W.A. and Thompson, T.L. (1986).Passive cooling with natural draft cooling towers in combination with solat chimneys. Proceedings, passive & low energy Arch. (PLEA), pecks, Hungary.

(9) Givoni, B. (1994). Passive and low energy cooling of buildings. Van Nostrand Reinhold company, New York.

(10) Olgyay, V. (1963). Design with climate. Princeton University press, New Jersey .

التكوينات الرملية : أخطارها ومواجهتها وتنميتها بساحل الدلتا المطل على البحر المتوسط بمصر

للدكتور / إبراهيم عبد الرحيم مشالى
أستاذ مساعد البيئة النباتية – كلية العلوم – جامعة المنصورة – مصر
E-mail : Sinfac@mum.mans.eun.eg

تعتبر التكوينات الرملية من أهم الخصائص المميزة لمنطقة الدلتا الساحلية وهى عبارة عن أكوام من الرمال المتراكمة والتى تختلف فى أشكالها وأحجامها وأماكن تواجدها. وفى الأساس أن هذه التكوينات تواجدت بفعل الرياح التى تهب من إتجاه الشمال الغربى على الساحل حيث تحمل هذه الرياح حبيبات الرمال من على شاطئ البحر المتوسط ثم تلقى بها على طول ساحل الدلتا حيث يزداد حجمها وتعلو وتسود فى أماكن أخرى من الساحل، كما آن لنهر النيل دور فى تكوين ساحل الدلتا وما عليه من تكوينات رملية خاصة اثناء فترات الفيضان فى العصور الماضية، ويتضح من ذلك أن أصل هذه التكوينات هو أصل هوائى بفعل الرياح وأصل فيضى بفعل فيضانات نهر النيل فى الماضى.

تقسيم التكوينات رملية بساحل الدلتا:

تنقسم التكوينات الرملية بساحل الدلتا الى ثلاثة أنواع رئيسية هى:

أ- التلال الرملية (**Mounds**) وهى عبارة عن أكوام رملية صغيرة تتراوح إرتفاعاتها ٢/-٢/١ متر وهى تنتشر على هيئة أحزمة موازية لساحل البحر بعد منطقة المد والجزر مباشرة ويمكن تقسيمها الى:

١- التلال الرملية الصغيرة (**Small sand mounds**) وهى تنتشر على طول ساحل الدلتا بعد منطقة مد وجزر البحر مباشرة ولايتجاوز إرتفاعها نصف المتر حيث ينمو عليها أفراد من نبات الرطريط المصرى **Zygophyllum aegyptium** و هذا النبات يساعد على تكوينها .

٢- التلال الرملية الكبيرة (**Raised sand mounds**) وهى تلال تقع خلف حزام التلال الصغيرة وهى أكثر إرتفاعاً منها حيث يصل إرتفاعها الى حوالى المتر أو أكثر وينمو عليها أفراد من نبات البصاق **Arthrocnemum macrostachyum** ونبات الغدانه **Halocnemum strobilaceum** .

ب- المصاطب الرملية: وهى عبارة عن رمال ناعمة توجد على هيئة صفائح رملية يبلغ ارتفاعها عدة بوصات، وعادة تتكون هذه المصاطب الرملية فوق المستنقعات الملحية، وبالتالى فإن ملوحتها قد تكون عالية نسبياً وذلك بسبب ارتفاع

ملوحة التربة تحتها خاصة فى الطبقة التحت سطحية لها وتقل الملوحة كلما إتجهنا الى أعلــى، ويمكــن تقسيم المصاطب الرملية فى المنطقة الى نوعين هما:

ا- المصاطب الرملية الملحية (**Saline sand flats**): وهى مصاطب قليلة الارتفــاع مسطحة تكونت أساساً فوق مستنقعات ملحية، حيث يسود هذه المصاطب غطاء نباتى من عشيرتى الندو **Cressa retica** والبوص **Phragmites australis** .

٢- المصاطب الرملية الغير ملحية (**Non-saline sand flats**) وهــى مصــاطب متوسطة أو عالية الارتفاع والتى تكونت فوق أراضى خصبة غير مزرعة حيث يسود عليها عشيرتى العاقول **Alhagi graecorum** ونبات النجيل **Cynodon dactylon** .

جـ- الكثبان الرملية (**Sand dunes**): وهى عبارة عن أكوام ضخمة من الرمال ذات القــوام المتوسط أو الناعم مع وجود نسبة قليلة من الغرين والطمى، وهذه الكثبان تختلف فيما بينها من حيث الارتفاع والانتشار والحركة والثبات وكثافة الغطاء النباتى.

والكثبان الرملية تسود أساساً الجزء الغربى والأوسط من ساحل الدلتا بينما تقل أو تختفي تمامــاً مــن الجزء الشرقي للساحل حيث تسود بيئات المستنقعات الملحية والقصبية ويمكن تقسيم الكثبان الرملية فى المنطقة الى الأنواع التالية:-

١- الكثبان الرملية المتحركة (**Mobile sand dunes**) و هى تكوينات رملية مرتفعة شــبه خالية من الغطاء النباتى، أو ينمو عليها بعض أفراد من نبات الجــازوف**Elymus farctus**أو نبات أستيبا **Stipagrostis scoparia** ، وهذه الكثبان تمثل الحزام الأمامى مــن مجموعــة الكثبان المواجهة لتآثيرات البحر المباشرة وهى من أخطر أنواع الكثبان فى المنطقة، حيث أنها دائمــاً نشطة وفى حركة مستمرة فتنقلها الرياح من مكان الى مكان آخر فتقوم بردم ودفــن كــثيراً مــن المزروعات والمنازل التى يقطنها بعض سكان المنطقة وحديثا الطريق الدولى وبالتالى فإن هؤلاء السكان دائماً فى مواجهة مستمرة مع أخطار هذه الكثبان النشطة حيث أن الظروف البيئية السائدة تســاعد هذه الكثبانعلى الحركة والردم والدفن والزحف ومن هذه الظروف مايلى:

أ- المواجهة المباشرة مع التيارات البحرية والرياح النشطة خاصة فى فصل الشتاء.

ب- الارتفاع الشاهق لهذه الكثبان وصغر حجم حبيباتها وخفة وزنها وعدم تماسكها.

ج- ندرة الغطاء النباتى الطبيعى أو انعدامه تماماً عليها.

ويكثر هذا النوع من الكثبان فى مناطق رشيد وبلطيم وقلابشو وزيان بساحل الدلتا .

٢- الكثبان الرملية شبه الثابتة (**Partial stabilized sand dunes**) وهى تمثل الحزام الثانى الذى يقع خلف الحزام السابق وهى عادة أقل ارتفاعا وأقل نشاطا حيث أنها أصــبحت شــبه محمية من مواجهة التيارات البحرية المباشرة، فأصبحت هناك فرصة أحسن لنمو بعض النباتات البرية ذات الطبيعة العشبية والشجيرية والتى بدورها تساعد على تثبيت واستقرار الكثبان ولو أنها أحيانــاً

تعانى من عمليات التعرية والنحر حولها نتيجة حركة الرياح، ومن أهم هذه النباتات التى تنمو علـــى هذا النوع من الكثبان مايلى:

أ- جيرات العوسج **Lycium schweinfurthii**

ب- شجير ات المتنان **Thymelaea hirsuta**

جـ- شجيرات كشك الماظ **Asparagus stipularis**

د- شجير ات الاتل (الطرفة) **Tamarix nilotica**

هـ- شجيرات الأرطا **Calligonum comosum**

وهى شجيرات معمرة، هذا بالاضافة لنمو بعض الأعشاب الحولية التى تظهر عقب سقوط الأمطار فى فصل الشتاء، وينتشر هذا النوع من الكثبان فى منطقة بلطيم و أبوماضى و الركابية.

٣- الكثبان الرملية الثابتة (**Stabilized sand dunes**) وهى تمثل الحزام الثالث والاخير من سلسلة الكثبان الرملية بمنطقة ساحل الدلتا والتى تقع للداخل من الساحل حيث أنها أصـــبحت أكثر حماية من التأثيرات البحرية المباشرة وتلك لوجود حواجز طبيعية أمامها من الكثبـــان والـــتلال الرملية سالفة الذكر، ولذلك فإنها أصبحت بيئة ملائمة لزيادة وكثافة الغطاء النباتى الطبيعى عليها، حيث يقوم بعض المزارعين بالمنطقة بزراعات محدودة حولها أو عليها من الخضراوات خاصة الطماطم والبطيخ وأشجار الفاكهة مثل التين والعنب.

الخصائص الفيزيائية للكثبان الرملية بساحل الدلتا:

من أجل تنمية الكثبان الرملية يجب دراسة خصائصها الطبيعية والالمام الكامل بجميع مواردها وكيفيـــة استغلال هذه الموارد وذلك لاستقرار هذه البيئة ووقف زحفها وتحاشى أخطارها المدمرة هذا من ناحية، كما أنه يجب الاستفادة من مواردها الطبيعية من الناحية الأنتاجية خاصة وأن المنطقة مدرجة فى الخطة القومية ضمن مناطق التنمية فى مصر.

الخصائص الفيزيائية للكثبان الرملية بساحل الدلتا:

من أهم الخصائص الفيزيائية لتربة الكثبان الرملية فى المنطقة أن رمالها من أصل حجرى رملى وحبيباتها مفككة ذات أحجام متوسطة ودقيقة ولايوجد بها جزيئات كبيرة الحجم

من الحصى والزلط ، وهذه الطبيعة تسهل من حمل الرياح لها ونقلها بسرعة من مكان الى آخر، كما أن مقدرتها على الاحتفاظ بالماء ضعيفة، كما أنها جيدة التهوية والصرف، ونسبة الرطوبة بهـــا قليلـــة فى الطبقات السطحية أو تحت السطحية، أما فى الطبقات العميقة فتعتبر الكثبان الرملية مخازن طبيعية جيدة لتخزين مياه الأمطار ويمكن الاستفادة منها فى أغراض الزراعة والتشجير.

الخصائص الكيميائية للكثبان الرملية بساحل الدلتا:

من أهم الخصائص الكيميائية للكثبان الرملية بساحل الدلتا أن تربتها عامة متعادلة أو قلوية ضـعيفة وفقيرة فى نسبة الكربون العضوى (الدبال) وكذلك فى محتوى كربونات الكالسيوم. أما الملوحة فإنها قليلة، والكتيونات معظمها من الصوديوم والماغنسيوم مع وجـود نسـبة قليلـة مـن البوتاسـيوم والكالسيوم، أما الأنيونات فمعظمها كبريتات وكلوريدات.

الخطة العلمية المقترحة لتثبيت الكثبان الرملية فى المنطقة:

يلقى موضوع تثبيت الكثبان الرملية وحجز الرمال اهتماما فى كثير من بلدان العالم، وذلك لما فى تحرك هذه الكثبان وزحفها من تأثير مدمر وتعويق لمشروعات التنمية، ونظرا لزيادة السـكان والحاجـة الى استغلال العديد من المناطق الغير مزروعة، فإن تثبيت الكثبان الرملية تمثل أهمية كبيرة فى حياة كثير من البشر.

وهناك طرق عديدة لتثبيث الكثبان أهمها مايلى:

١- طريقة التغطية بالاسفلت: وهى تعتمد على تثبيت الكثبان بالكيماويات وذلك بخلط الأحجـار الصغيرة بالاسفلت والزيت الخام ثم ترش الخلطة على الكثبان الرملية وتترك لتجف وتتصلب مكونة غطاء يمنع حركة الرمال، الا أنها لاتفى بالغرض لأنها باهظة التكاليف وغير دائمة حيث أن عوامـل التعرية تؤدى الى تشقق هذه الطبقة وتصدعها بعد فترة من الوقت واندثاره بعد أعوام قليلة، كما أن لونها الداكن يساعد على ارتفاع درجة حرارة المكان خاصة فى الصيف.

٢- طريقة الاستزراع: وهى الطريقة المثلى خاصة فى المناطق الساحلية حيث يسقط المطـر بـوفرة، وتتلخص باتباع الآتى:-

أ- تستعمل حواجز من أعوام النباتات الجافة وجذوع النخل والسعف بحيـث تكـون هـذه الحواجز على خطوط متعامدة، أى أنها تقسم سطح الكثيب الى مربعات وهـذا مـايرف بالتثبيت الميكانيكى.

ب- زراعة أنواع من النباتات الرواد المحبة لبيئة الرمال حيث أن هذه النباتات تستطيع أن توائم المعيشة فى هذه البيئة كما أنها ذات طبيعة نمو أفقى فوق وتحت الرمال على هيئة شبكة من السيقان الأرضية والسيقان الجارية ومن أمثلة ذلك بعض نباتات العائلة السعدية والعائلـة النجيلية وهى نباتـات تنمـو أساسـاً بالمنطقـة مثـل **Stipagrostis lanata – Cyperus conglomeratus – Cyperus capitatus** وغيرها.

ت- زراعة أنواع نباتية تعقب نباتات الرواد ذات طبيعة تقاوم الردم من أعلى والخلع من أسـفل وذلك بسبب سرعة نموها الخضرى عن طريق البراعم الهوائية وأيضا لوجود جذور شادة بها ومن هـذه النباتـات الجـازوف والبوصـيل والأبصـال البريـة (**Pancratium maritimum – Silene succulehta Stipagrostis scoparia – Elymus farctus**) وغيرها.

ث- إدخال أنواع نباتية ذات طبيعة شجيرية تستطيع أن تقاوم وتنمو فى ظل التمهيد الذى أحدثته النباتات فى الخطوات السابقة ومن أمثلة هذه الشجيرات العوسج والمتنان وكشك ألمـاظ والأثل والسنط البلدى والتين والعنب.

ج- زراعة أنواع نباتية ذات طبيعة شجرية مثـل السـنط الأوروبى- الجازورينـا- النـيم - الزنزخت- الطرفة- وغيرها وهى أشجار تستطيع أن تنمو فى بيئة قد حدث فيها كثير من التغيرات التى أدت الى الثبات الجزئى فى حركة الكثبان وهو مايسـمى **subclimax** فى التعاقب النباتى على بيئة الكثبان الرملية وهذا ماسوف يؤدى فى النهاية الى الثبات الكامل حيث باستمرار زيادة ونمو هذه الأشجار خاصة أن جذورها وتدية طويلة تصـل الى المـاء المختزن فى باطن الكثبان سوف ستزداد كثافة الغطاء النباتى على الكثبان. ويمكن القول أنه باستمرار الوقت سوف تصبح هذه الكثبان حدائق خضراء تقوم بتغيير اللون الأصـفر الى اللون الأخضر بالمنطقة.

بعض مزايا تثبيت وتنمية الكثبان الرملية فى المنطقة:

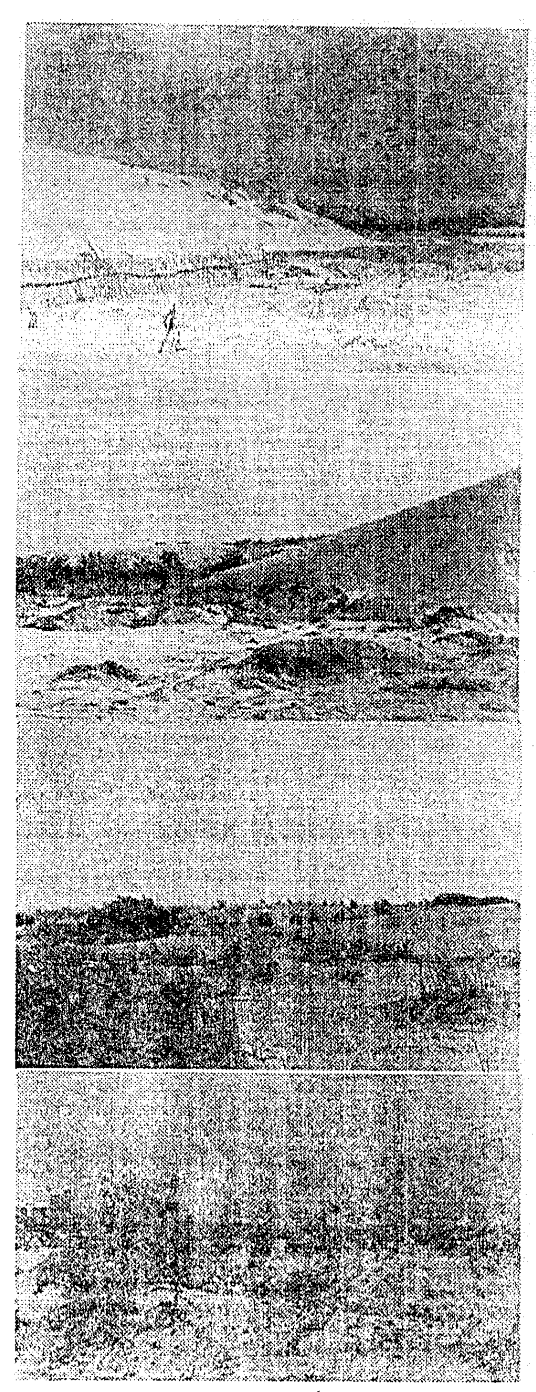
١- إتزان النظام البيئى فى المنطقة والوصول به نحو الاستقرار.

٢- تلطيف درجة حرارة المنطقة وتنقية الهواء من بعض ملوثات الجو وأهمها غاز ثانى أكسيد الكربون وأكاسيد النيتروجين.

٣- حماية المزروعات، والمجتمعات الجديدة التى سوف تقام فى المنطقة من أخطار الردم بالرمال وحماية الطريق الدولى من زحف الرمال.

٤- الاستفادة من انتاجية الغطاء النباتى البرى المستخدم فى تثبيت الرمال خاصة الأنواع ذات الأهمية الاقتصادية كمصادر طبيعية متجددة.

٥- جذب وتنشيط السياحة الداخلية لمناطق جيدة تريح الصدور وتبهج النفوس.



نماذج مختلفة للكثبان الرملية بساحل الدلتا

1-Abu A1-Izz, M.S.(1971), Landforms of Egypt. American Univ. Press .Cairo

2-Ayyad, M.A. (1973). Vegetation and environment of the western .Mediterranean coast of Egypt. I. The habitats of sand dunes. Jour .525-509 :61 .OfEcol . 61: 509-525.

3-Ayyad, M.A. & E1-Bayyomy, M.A. (1980). Phytosociology of sand dunes of the western Mediterranean desert of Egypt, in: Glimpses of Ecology. Ed. J.S. Singh & B. Gopal Published by International .Scientific Publications .

4- Batanouny, K.H. (1965). Sand dune vegetation of El-Arish area. Bull .23-39:11 ,.Far. Sci., Cairo Univ., 39: 11-23.

5- Bhimaya, C.P., Kaul, RN. & Ganguli, B.N. (1962). Sand dune rehabititation in Western Rajasthan. Proceedings of the 5th World: Forestry Congress 362-385.

6- Chapman, V.J. (1949). The stabilization of sand-dune vegetation .1948 ,Proc. Conf. Biology and Civil Engineering, London, 1948.

7- Kassas, M. (1955). Rainfall and vegetation belts in arid North-East .59-49 ,Africa, Plant Ecology: Proc. Of the Montpellier Symposium, 49-59.

8- Mashaly, I.A. 1987. Ecological and floristic studies of Dakahlia Damietta region, Ph.D. Thesis, Faculty of Science, Mansoura . University, Egypt .

9- Nikman, F. & Ahranjani, B. (1975). Dunes and development in Iran Ministry of Agriculture & Natural Research, Forest and Range . .Organization. Tehran .

10-Ranwell, DiS. (1972). Ecology of salt Marshes and sand dunes .Chapman and Hall, London.

11-Serag, M.S.(1986). On the ecology of the Damietta Coastal Area .M.Sc. Thesis, Fac. of Sci., Mansoura Univ., Egypt .

12-Zahran, M.A. & Willis, A.J.(1992). The vegetation of Egypt .Chapman and Hall, London .

13-Zohary, M. 1973. Geobotanical Foundation of the Middle East. Vols .1 & 2. Gustav Fisher Verlag, Stuttgart

14-Zohary, M. and Fahn, A.(1952). Ecological studies on East .53-38 :(4)1 ,Mediterranean dune plants. Bull. Res. Counc. Israel, 1(4) : 38-53.

مشكلة الثروة السمكية في إفريقيا ومستقبلها

أ.د حلمي ميخائيل بشاي
كلية العلوم – جامعة القاهرة

تعتبر افريقيا من أغنى القارات في مصادرها المائية سواء من المياه العذبة أو البحرية وتشمل المياه العذبة مساحات شاسعة في افريقيا تتمثل في أنهارها ، واطولها نهر النيل والبحريات ومهنا بحيرات قديمة مثل فكتوريا وتانجنيقا ، اضافة الى الجداول والاغادير والراضي الرطبة الشاسعة .وتمتلك افريقيا شفوعا سمكيا هائلا به ثروة جينية ينبغي لمحافظة عليها ، اذ انها مهددة بالانقراض . وقد سجل في أفريقيا مايزيد على ٦٤٠٠ نوعا من الأسماك الزينة والأنواع المستقدمة . ومما لاشك أن هناك عددا كبيرا من الأنواع لم يكتشف بعد.

وتعتبر افريقيا هي المصدر الاصلي لجاميع الاسماك وعلى وجه الخصوص البدائية وانواع البلطيات والتي تنتشر بدرطة أقل في بعض القارات ، لكن يعتقد أنها تبعث أصلا من أفريقيا عندما كانت تلك القارات متصلة في قارة واحدة كندناوا ، وعلى سبيل المثال يوجد في بحيرة فيكتوريا مايزيد على ٤٠٠ نوع من البلطيات ، وبحيرة مالادى ٣٠٠ – ٤٠٠ نوع ، تانجنيقا ٢٠٠ نوع أغلبها مستوطن.

إن معظم الآسماك في افريقيا وعلى وجه الخصوص المستوطن منها مهدد بالانقارض نظرا للتغيرات الكبيرة في النظم البيئية بسبب التلثو ، واقامة السدود والصيد الجائر واستقدام انواع جديدة من الآسماك ، كما حدث في بحيرة فيكتوريا حي ثكان البطليات تمثل ٩٩% من الكتلة الحيوية ، وبعد ادخال سمك قشر بياض في الخمسينات اصبحت البلطيات لاتمثل سوى حوال واحد بالمئة.

والجدير بالذكر أن معظم البلاد الافريقية يعتمد على الاسماك كمصدر رئيسي اساسي للبروتين الحيواني مثل ملاوى التي تعتمد على ٧٠% من الأسماك كمصدر للبروتين ، وفي السنوات الأخيرة حدث تدهور للثروة السمكية منها في جنوب بحيرتي مالاوى ونيلسا .

وتتلخص مشاكل الثروة السمكية الافريقية في :

١- الانقراض المستمر للكثر من الأنواع وخاصة المستوطن منها ، مما يهدد التنوع السمكي وفقد المخزون الجيني والمثلى على ذلك كثيرة مثل ماحدث ببحيرة فكيتوريا وملاوى ونياسا مما يدعو الى اتباع برنامج وبذل جهود محلية وعالمية لصيانة تلك الأنواع بتحديد مناطق من البحيرات كحميات طبيعية للمحافظة على تلك الأنواع وإكثارها .

٢- استدعت الحاجة القصوى لاستخدامات المياه والتي ستعاني نقصا خلال القرن الحالي الى اقامة السدود والخزانات مما يؤدي الى تغيرات جذرية في النظم البيئيـــة وتحـــول مناطق شاسعة من بيئة نهرية الى بحيرية مكايتبع ذلك من اختفاء كثير مـــن الأسمـــاك النهرية ومن أمثلة ذلك بحيرة ناصر التي سجل فيها ٥٦ نوعات من الأسماك في باكور انشائها وفيها تعتمد ٩٠ – ٩٥٪ من المصائد على البطليات .

٣- إن انتشار النباتات المائية وخاصة مايعتبر انه مثل ورد النيل يؤدي الى تدني نوعية الماء سواء لمعيشة الأسماك وغيرها من الكائنات أو استخدامها للشـــرب الخ اضـــافة الى صعوبة الصيد بتلك المناطق التي ينمو فيها ورد النيل بكثافة . لذلك ينبغي أن تتضافر الدول الأفريقية لايجاد الوسائل الفعالة للتخلص من تلك الآفات .

٤- لقد أدى الطلب المتزايد على الأسماك لزيادة إمداد السكان الى تدهور المصـــائد في اكثر من المسطحات المائية الافريقية ، بسبب الصيد الجائر واستخدام صرف غـــير قانونية مما يستدعي وجود ادارة فعالة وتبادل الخبرات للمحافظـــة علـــى الثـــروة السمكية.

٥- يعتبر التلوث من أهم المشاكل التي تجابه الثـــروة الســـمكية في الـــبلاد الافريقيـــة واستخدام الممارسات المتقدمة للزراعة والتوسع في استخدام المبيدات والتلوث من الصرف الصحي والصناعي ادى الى تغيرات جذرية في النظم البينية والتي لاتقتصر على منطقة واحدة بل تمتد بطول الأنهار وظهر تأثيرها في مناطق أخرى و لايفوتنـــا هذا نذكر بينة المستنقعات والأراضي الرطبة لبحيرة فكتوريا القطاع الكيني مايزيد على ٤٠ نوعا من الأسماك المستوطنة مهددة بالانقراض

٦- لقد ادى ادخال انواع مستقدمة من الأسماك ســـواء في الـــبحيرات أو الخزانـــات الصناعية دون دراسة متأنية وجادة الى تدهور مصائد تلك المناطق . والأمثلة كثيرة مثل استقدام سمك قشر بياض (السادوس) في الخمسينيات في بحيرة فيكتوريا ادى الى اختفاء مايربو على ٩٠٪ من البلطيات والتي كانت ستقضي على العوائق النباتية والتي انتشرت بكثافة في البحيرة وادى تحللها الى افقار البحيرات في اللاكسجين ، اضافة الى استخدام الاخشاب في تدخين سمك قشر بيـــاض ممـــا ادى الى اختفـــاء مساحات شاسعة من الغابات وتآكل التربة وزيادة عكارة الـــبحيرة ، اضـــافة الى حرمان السكان المحليين من غذاء بروتين رخيص

٧- أدى التطور المذهل في استخدام وسائل حديثة للصيد والتصنيع الى تـــدهور دخـــل الصيادين ، وحرمهم من غذاء بروتين هام وأجبرهم على استخدام وســـائل صـــيد مدمرة.

٨- إن وضع استراتيجيات لإدارة مصائد بتحليل المعلومات منه وتقديرات المخزون السمكي وجهد الصيد. وأنواع الأسماك المصيدة من أهم الوسائل للاستغلال الأمثل المستدام للثروة السمكية الأفريقية التي آخذت في التدهور .

٩- من أهم وسائل تنمية الثروة السمكية سواء من المايه الغذبة أو البحرية هو التوسع في الاستزراع السمكي ورغما إن افريقيا غنيه بمسطحاها المالية الهائلة فقد قدر الانتاج السمكي من الاستزراع بافريقيا بحوالي ١٠٠الف طن/ والجدير بالذكر أن طبقا للاحصائيات الرسمية فان انتاجية المزارع السمكية بمصر عام ١٩٩٩ كانت ٣,٢٢٦ الف طن/عام . لذلك فالتوسع في الاستزراع السمكي وتبادل الخبرات وعقد الندوات لاشك ستساعد في التوسع في الاستزراع . وتجدر الإشارة الى استخدام البلطيات من اصل افريقي ــ على نطاق وساع في الاستزراع السمكي على مستوى العالم.

١٠- إن التوسع في اقامة السدود في الدول الافريقية يستدعى دراسات اضافية على الاسماك والأحبار المالية في تلك المناطق وعلى وجه الخصوص المهاجرة منها حتى يمكن انشاء ممرات او سلالم للأسماك والقشريات المهاجرة طبقا لمواصفات معينة تأخذ في الاعتبار نوعية الأسماك حتى يمكن تصميم تلك الممرات لتكون فعالة.

أن بالقارة الافريقية امكانيات هائلة لاستغلال الثروة السمكية لتكون مصدر رئيسيا للبروتين الحيواني ، ويمكن تنمية تلك الثروة بالادارة الفعالة وضع الصيد الجائزوالحفاظ على انوع السمكي مع التوسع في الاستزراع السمكي.

طريقة جديدة لرى الأراضى الرملية بالترشيح

أ.د عبدالله نجيب

معهد البحوث والدراسات الأفريقية – جامعة القاهرة

تقديم :

معروف أن العالم يعانى من نقص حاد فى الموارد المائية ، التى تتناقص يوما بعد يوم لأسباب عديدة لا مجال لذكرها ، ومعروف أيضا أن كثيرا من الدول بها مساحات هائلة من الأراضى الصحراوية التى لا يمكن زراعتها بسبب ندرة المياه وعدم كفايتها ، وتبلغ هذه المساحة فى مصر – على سبيل المثال – أكثر من ٩٥% من جملة مساحتها .

اهمية الماء :

ومعروف أن للماء أهمية بالغة فى حياة الانسان والحيوان والنبات . فهو مصدر الشرب للأنسان والحيوان والنبات ، علاوة على ضرورته فى أغراض أخرى كثيرة . ولا يمكن أن تقوم حضارة أو أنشطة اقتصادية أو حتى عمران بشرى دون وجود القدر المناسب من المياة . هذا بالاضافة الى استخدامة فى الصناعة والنقل والمواصلات وغير ذلك .

مشكلة المياه بالنسبة لمصر :

ومصر بصفة خاصة لها وضع منفرد بالنسبة لهذه المشكلة ، فهى من جهة :

١– لا توجد بها موارد مائية يمكن الأعتماد عليها سوى نهر النيل الذى يمثل ٩٧% من موارد مصر المائية .

٢– أن حصة مصر من مياه النيل ، والتى تبلغ ٥٥,٥ مليارم٣ لا تكفى رى الأراضى المصرية المزروعة . مما يضطرها إلى إعادة استخدام المياه ، وهو ما يؤثر على خصوبة الارض ومعدلات الانتاج ، ولا يتيح لها الفرصة لاستصلاح واستزراع أراضى جديدة .

٣– نتيجة للزيادة السكانية ، فلن تكفى موارد المائية الحالية على الاطلاق حتى عام ٢٠٠٠ لأن مصر ستكون فى حاجة الى نحو ٧٧ مليارم٣ وهو أمر من الصعب تحقيقة فى الظروف الحالية .

٤– سيرتب على نقص المياه اثار ومشكلات بالغة الخطورة ، وهى مشكلات اقتصادية وسياسية واجتماعية وبيئية ، وسيكون من الصعب حلها .

محاولات الحل :

ونظرا للزيادة السكانية المتناسبة فى مصر ، والحاجة الى اراضى زراعية جديدة ، ومع ندرة المصادر المائية ، بدأ العلماء يفكرون فى وسائل جديدة لتنمية الموارد المائية ، وترشيد استخدام ما هو موجود منها ، ومن هذه المحاولات :

١– تخزين مياه الأمطار سطحيا أو جوفيا فى بعض المناطق وتعديل سريانها الى نهر النيل فى مناطق أخرى .

٢- العمل على تثبيت التربة بوسائل مختلفة المياه .

٣- محاولة تنمية موارد نهر النيل بالتحكم فيه وتنظيم ايراده السنوى واستخدام وسائل كثيرة ، منها السدود والتنبؤ والمتابعة وغير ذلك .

٤- محاولة عقد اتفاقيات جديدة مع دول حوض النيل لتنمية ايراد النهر ، وزيادة حصة مصر .

٥- ترشيد وسائل استخدام المياه ورفعها ونقلها .

وقد توصل العلماء الى استحداث طريقتين جديدتين للرى هما :-

أ- الرى بالرش

ب- الرى بالتنقيط

ومع ذلك تظل مشكلة نقص المياه فى مصر مشكلة تحتاج الى حلول غير تقليدية وعلى ضوء ذلك ، فقد يكون من المفيد أن تقوم الحكومة المصرية بتقييم هذه المحاولة

تجربة الطريقة الجديدة

راقبت بعناية بالغة طريقة الرى بالرش ، وطريقة الرى بالتنقيط وأدركت أن لهما عيوب لا تخفى على العلماء ، ومن ذلك صعوبة تنفيذ هاتين الوسيلتين على نطاق واسع فى مساحات كبيرة .

ومضمون فكرتى كا لأتى :-

- يمكن الرى بطريقة الترشيح باستخدام انابيب من فخار (١١) تركب بها كيزان من فخار ذا حسام .

- التى تسمح بترشيح قدر من المياه يكفى لرى الأشجار أو غيرها من المزروعات فى الأراضى الرملية ، ويمكن استخدام نفس الطريقة فى رى بعض المزروعات فى الأراضى الطينية . وقد قمت بتجربة الطريقة الجديدة على نطاق ضيق ، ونجحت التجربة نجاحا مبهرا وكانت النتائج كالأتى :

١- أن رى نبته أو شجرة بالطريقة الجديدة قد وفر نسبة تزيد كثيرا عن ٥٠٪ من كمية المياه اللازمة لرى نفس النبته أو الشجرة بطريقة التنقيط .

٢- أن الانابيب الفخارية علاوة على انها وسيلة توصيل ، فإنها فى هذه الحالة تقوم بالاضافة الى التوصيل بالرى .

٣- أنها كانت أكثر نجاحا فى رى النبات المزروع فى أرض رملية .

٤- انها تصلح أيضا لرى النباتات المزروعة فى الأرض الطينية اذا وضعنا حول الكيزان الفخارية قدر من الرمال حتى لا يسد الطين .

٥- أنها اكثر استدامة وارخص تكلفة ، وخاماتها متوفرة وسهلة الاعداد .

٦- يمكن استخدام مصدر واحد لرى أراض بعيدة جدا عن المصدر لأن الانابيب الفخارية وسيلة توصيل ورى فى نفس الوقت .

٧- أن هذه الطريقة لا تسمح اطلاقا بتبخر المياه ، مما يوفر قدرا كبيرا من المـــاء المهــدر بالتبخير .

٨- الأنبوب الرئيسى الحامل لمياه المصدر ، يمكن تفريعه بسهولة الى انابيب اخرى فرعيـــة كثيرة ، لرى اكبر مساحة ممكنة وتبدو فى هذه الحالة كشبكة من الانابيب تحت الأرض (انظر شكل رقم ١)

٩- يمكن دهان الانابيب الرئيسية أو جزء منها حسب الطلب أو حسب حاجة ومكـــان الاشجار والنباتات المطلوب ريها بمادة تسد لمنع تسرب المياه بالبخر .

١٠-يمكن عمل شبكة من أنابيب ذات اقطار مناسبة وتدفن تحـــت الارض ، اذا كانـــت مزروعة بالحشائش او النباتات المتمددة كالخيار والقناء والبطاطا ، وهـــذه الشـــبكة صالحة لاستخدامها فى رى الحدائق العامة فى المدن .

١١-يمكن أيضا وضع الانابيب الرئيسية فوق سطح الارض أو تحتها حسب الطلب ، وان تدهن الأجزاء الموصلة لسد ....

١٢-يمكن استخدام الانابيب الموصلة من مواد اخرى كالمعادن او البلاستيك وتركب بهـــا الكيزان فى الاماكن اللازمة تحت المزروعات .

١٣-يمكن التحكم فى اطوال الكيزان حسب الطلب وطبقا لدرجة نمو وعمق جذر النبات .

١٤-يجب ملء الانابيب بالهواء فى حالة عدم استخدامها حتى لا هى نفسها المياه من حـــول الجذور.

الخاتمـــــــــة :

آمل من كل قلبى أن تؤدى هذه الطريقة الى حل مشكلة نقص المياه فى مصـــر ، وآمـــل أن تقتنع الحكومة المصرية بقيمنها وأن تقوم بتجربتها على نطاق اكبر ، وكما يقال فإن التجربة خـــير برهان ولو نجحت هذه التجربة سيترتب عليها نجاح فكرة اخرى سوف اعرضـــها فى حينـــها ، سيرتب عليها زيادة انتاجية الاراضى المزروعة فى الوادى بما لا يقل عن الثلث . .

تكيف النباتات للبيئات الصحراوية

د.سامية يحيى شكري

تعتبر الغابات ، الحشائش ، الصحراء الشجيرية والتندرا اكبر اربعة تكوينات نباتية على سطح يابس الأرض ، وفي القارة الافريقية تعتبر الغابات ، الحشائش الصحراء الشجيرية والصحراء الفقيرة اكبر التكوينات النباتية لبيئة اليابس.

تمثل هذه التكوينات انعكاسا واضحا للمناخ ، عامة تتواجد الغابات ومناطق الأشجار الخشبية بالمناطق الرطبة ن بينما تسود الصحراء الشجيرية والصحراء الفقيرة بالمناطق الجافة شبه الحراوية والصحراوية حوالي أكثر من نصف مساحة يابس القارة الأفريقية تصنف الخضراوات الأفريقية الى إقليمين أساسيين.

- الصحراء شمال دائر الاستواء (صحراء النصف الشمالي للقارة الأفريقية)
- الصحراء جنوب دائرة الاستواء (صحراء النصف الجنوبي للقارة الأفريقية)

يتميز الإقليم الأول بالعديد من أنماط الصحراء وشبه الصحراء مثل :

أ - الصحراء الساحلية وتشمل الساحل الشرقي للبحر المتوسط .

ب - الصحراء الساحلية للمحيط الاطلنطي .

ج - الصحراء القارية (الصحراء النوبية) وتعتبر اكبر الصحراوات بالعالم.

د - الصحراء الساحلية للبحر الأحمر.

بينما تمثل صحراء ناميبا اقليم الصحراء بجنوب غرب القارة الافريقية .

تتميز الصحراوات الافريقية بظروف مناخية خاصة تعتبر عوامل محددة الغطاء النباتي بها وهي :

١- ندرة المطر .

٢- درجات الحرارة .

٣- الرياح.

وعوامل أرضيةتتمثل في طبيعة سطح اليابس بالمناطق الصحراوية سالفة الذكر (رملي أو صخري).

تتكيف بذور ونباتات المناطق الصحراوية لظروف الأمطار :

١- تحتوي بذور بعض النباتات الصحراوية على بعض الهرمونات المثبطة للنمو ، فلا يحدث الانبات الا اذا توافر قدر من الامطار كاف لغسيل هذه الهرمونات .

٢- تتميز بذور بعض النباتات الصحراوية بحساسيتها لكمية الأمطار ، فعلى الرغم من الها لاتحتوي على أي هرمونات مثبطة لحدوث الانبات الا الها لاتنبت الا اذا توافرت كمية امطار كافية لنموها الخضري والثمري.

٣- تتميز بذور بعض اجناس انواع العائلة بالقولية بقصرات صلبة غير منفذة للماء وحيوية تمتد لسنوات عديدة وبهذه الصفات تستطيع مقاومة ظروف ندرة الأمطار بالمناطق الصحراوية .

٤- ينمو المجموع الجذري للنباتات الصحراوية المعمرة نموا سريعا حتى يظل في مأمن من الجفاف السريع للطبقة السطحيةللتربة وبهذا يصل بنموه السريع الى الطبقة الدائمة الرطوبة التحت سطحية بينما يتميز المجموع الجذري للنباتات الصحراوية الحولية بالتفرع الأفقي الغزير ممـــا يمكنه من الاستفادة باكبر قدر من الرطوبة السطحية .

٥- تتميز النباتات الصحراوية الحولية بقصر فترة حياتها (سرعة النمو الخصري والثمري) وبهذا تستطيع الاستفادة منالماء المتاح لها قبل أن تجف التربة .

٦- تستفيد جذور النباتات الصحاوية المعمرة بالندى الداخلى والذي يتكون داخل التربة على صورة بخار ماء يتكاثف بالطقة السطحية بالتربة حيث تنخفض درجة الحرارة الىالحد الذي يسمح بتكاثف بخار الماء الى قطرات ماء ترطب الطبقة السطحية للتربة .

٧- يحافظ التكاثف السطحي لبخار الماء (الندى الخارجي) خاصة في شهور الجفاف على حيـــاة النباتات المعمرة حيث تكون هذه النباتات جذور رقيقة وقتية تستفيد من الرطوبة الوميـــة خلال ساعات الصباح البكرة اثناء موسم الجفاف .

٨- تمتص اوراق النباتات المعمرة الندى المتكاثف عليها .

٩- يتميز العديد من النباتات الصحراوية المعمرة بقدرتها على النمو السريع اذا ماتغطت بالرمال (في حدود قدرة كل نوع على النمو السريع) وبهذا لاتضار هذه الانواع النباتية بالرمال السافية ، وعلى العكس من ذلك تضار اذا ما تكشفت جذورها بالتعرية .

١٠- تتميز جذور النباتات الصحراوية النامية بالصحراوات ذات التربة الصحرية بقدرتها على النفاذ داخل السطح الصخري أو التغلغل بين شقوقه.

ابحاث الموارد الحيوانية فى قسم الموارد الطبيعية بمعهد البحوث والدراسات الأفريقية

وفائى زكى عازر ميخائيل
قسم الموارد الطبيعية – معهد البحوث والدراسات الأفريقية
جامعة القاهرة

الملخص

اسس قسم الموارد الطبيعية فى عام ١٩٧١ كجزء من معهد البحوث والدراسات الأفريقية ركـزت الابحاث فى الموارد الحيوانية فى المرحلة الاولى على ديدان الارض فى دلتا النيل والوادى بعـد ذلـك تضمنت الابحاث المجموعة الكاملة للحيوانات التى تعيش بشكل مؤقت أو دائم فى التربة والتى يطلـق عليها حيوانات تربة ، وأكثر بشكل محدد على اللافقاريات مع وجود بضعة استثناءات موضـوعات الابحاث تضمنت دراسات الحصر والدراسات التطبيقية دراسات الحصر بهدف الى معرفـة الانـواع المتوجداه والتركيب البنائى لها فى نظام بيئى ما ، من خلال الدراسات البيئية والبيولوجية عن المجموعة الكاملة او مجموعة محددة أو نوع واحد ، من خلال دراسة تأثير كل من اطرق الزراعية – الحماية من الرعى – نوع الغطاء النباتى – مقاومة الحشائش بالطرق الفيزيائية على حيوانات التربة فى الصحارى والنظم البيئية الزراعية فى الصحراء او فى وادى النيل والدلتا شملت التطبيقية أيضا المقاومة البيولوجية للافات الزراعية باستخدام الفيروسات والفطريات والمفترسات والمستخلصات النباتية والطفليـات تغيير مواعيد الزراعة او التكثيف المحصولى ، مما يقلل استعمال المواد الكيمياوية ويمنع تلوث البيئة تهتم الابحاث مؤخرا بدراسة التنوع لحيوانات التربة فى الموائل المختلفة وتأثرها بالعوامل البيئية فضلا عـن البيئة الارضية فان البيئة المائية العذبة والبحرية قد اخذت فى الاعتبار فى دراسات الموارد الحيوانيـة ، مثل القواقع والنباتات المصاحبة لها كذلك البعوض ومفترساته مياه النيل ، ومجموعة المرجانية البانيـة للشعاب فى مواقع بالبحر الأحمر . وشملت الدراسات الفقاريات الكبيرة مثل دراسات طفيليات الدم فى الماشية والجاموس ، تغذية الطيور الداجنة ، كفاءة هضم بعض العلف لزيادة انتاجية الجترات الصغيرة واصابة الدجاج بالميكوبلازما وتأثيره على معدل انتاجيتها كل هذه البحوث قد اجريت فى الصحارى الغربية والشرقية وسيناء ووادى ودلتا النيل بمصر وامتدت الى السودان وأوغندا وكينيـا وتانزانيـا وزاميبا وزيمبابوى ونيجيريا .

النباتات الطبية فى مصر

مصدر حيوى متجدد تحت الخطر

د.محمد عبد العزيز الدمرداش – استاذ البيئة النباتية – جامعة المنصورة

توفى الظروف البيئية الجفافية السائدة فى مصر ميزة نسبية لنوعية وكمية النباتات التى تحتوى على نسب عالية من المركبات والمواد ذات الأثر الطبى الفعال . تمثل النباتات الطبية نسبة عالى فى الفلورة المصرية دراسات مسح البيئة المصرية اكدت على الامكانيات الممتازة لعدد كبير من فصائل النباتات العطرية والطبية فى مصر .

تقدر قيمة ما يصدر حاليا من هذه لنباتات (اغلبها توابل) بحوالى ٤٠٠,٠ مليون جنية مصرى – هذا غير ما يتم استهلاكه منها . حاليا مصر تصدر نسبة غير مناسبة لامكانياتها فى هذا المجال من تلك النباتات (٠,٦% من احتياجات الاتحاد الأوروبى مثلا).

واذا كانت الندرة هى احد سمات الفلورة المصرية فان النباتات الطبية وبصفة خاصة معرضة لمزيد من خطر الانقراض من مصر وقبل أن تصل الى هذا المصير فانها حاليا تواجه اخطار عديدة : التدهور الوراثى ، الجمع الجائر من البرية ، سوء التعريف ، نقص المعرفة العلمية المتصلة بتقدير الانتجية و اخيرا تفتت وتناثر الجهود المتصلة بالتعامل مع تلك النباتات.

تحتاج ادارة هذا المصدر الواعد الى برنامج قومية حقيقية لاعادة التأسيس يشترك فيها العديد من الجهات وتتلخص الجهود المطلوبة فيما يلى :

١- بناء قاعدة معلومات متكاملة لتحسين ادارة وتيسير استخدام المعلومات المتوافرة فى المجالات المتعددة التى ترتبط بتلك النباتات بدأ من نتائج المسوح الحقلية ومرورا بالتدريب على التقنيات الحديثة فى مجال التحليل الكيميائى للنباتات حتى لا يتم استهلاك كميات كبيرة منها وانتهاء بمعرفة افضل اساليب تنمية وإكثار كل نوع منها .

٢- تمويل المشوعات البحثية الحقلية التى تتضمن بحث : حفظ الاصول الوراثية لكل تلك النباتات و دراسة اسباب التدهور الوراثى لتلك النباتات .

٣- اجراء دراسات تختص بتقدير انتاجية كل نوع والتدريب على انتاج تلك النباتات بطرق غير تقليدية و ادخال الأنواع الجديدة ودراسة امكانية قلمتها للظروف المصرية .

٤- تطوير البنية الاساسية العلمية القادرة على البحث فى هذا المجال من خلال توفير اجهزة متقدمة للتحاليل الدقيقة والتدريب عليها .

٥- تطبيق برامج الحماية على بعض الانواع النادرة بعرفة المحميات التى تضم تلك النباتات

٦- التوسع فى تطبيق اسلوب زراعة الانسجة فى انتاج تلك النباتات واستعادة النادر منها .

٧- تطوير استراتيجية لتسويق تلك النباتات ومستخلصاتها على اساس المعايير الدولية لجودة المنتج وايجاد سياسات ترويجية صحيحة والتنسيق بين الاطراف المتعددة المتصلة بمجال انتاج وتصدر النباتات الطبية .

صون الحياة البرية : أهميته وخصائصة

أ.د. كمال حسين شلتوت

قسم علم النبات ، كلية العلوم ، جامعة طنطا

ملخص

تتناول هذه الورقة اهمية صون الحياة البرية والتنوع البيولوجى (الأحيائى) خاصة فى المناطق التى تتميز بدرجة عالية من الهشاشة ، كما هو الحال فى مناطق عديدة من الوطن العربى ، من اجل صون أفريقيا الضخمة من الجينات (المورثات) المعرضة للانقراض .

وتتناول الورقة أيضا الخصائص التى يجب اخذها فى الاعتبار عند اختيار انسب المواقع لتطبيق صـــون الحياة البرية فيها مثل :

١- التنوع
٢- الندرة
٣- الحالة الطبيعية
٤- المساحة
٥- التدخل البشرى
٦- النموذجية
٧- القيمة العلمية والتربوية
٨- القيمة الترويحية
٩- التاريخ المسجل للمنطقة
١٠- التميز
١١- الهشاشة البيئية
١٢- ومجموعة اخرى من العوامل الأقل فى الأهمية

وتعطى الورقة تعاريف هذه الخصائص وأساليب قياسها

وتنهى الورقة بتقييم عام للموازنة بين المناطق المرشحة واشارات للمناطق الأكثر اهمية عن غيرها ، مع امثلة تطبيقية لبعض المناطق المصرية .

نبذة تاريخية عن علم التصنيف

أ.د. آمال أمين عبد الواحد – قسم علم النبات – كلية العلوم / جامعة القاهرة

التصنيف وظيفة طبيعية في حياتنا فيجب معرفقت النباتات التي نتناولها في حياتنا اليومية . وعلم التصنيف أساس لبعض فروع العلم الأخري وفي نفس الوقت يعتمد عليها .

أهداف علم التصنيف-

١- وضع أسس ومعايير لتعريف النباتات
٢- مراعاة التعبير عن العلاقات الطبيعية وتطور النباتات
٣- دراسة العوامل التي تؤثر علي النباتات من بيئة ومناخ وعوامل بيولوجية

ويمكن القول بأن علم التصنيف مر بمرحلتين أساسيتين هما :

١- ما قبل داروين
٢- ما بعد داروين

١- ما قبل داروين :

وتتميز هذه الفترة بأن بني التقسيم فيها علي صفات ظاهرية منها طبيعة النمو . ومن الأوائل في هذا الاتجاه (C.370- & 87B. C.) **Theophrastus** وهو تلميذ العالم ارسطو . وقسم النباتات إلي نباتات عشبية وخشبية . أما العالم السويدي (1707-78) **Carl Linnaeus** فقد أسس تصنيفة للنباتات علي أساس عدد الاسدية التي تمثل الطلع وهو عضو التذكير في النبات : كما قام بوضع الأساس لتسمية النباتات وهو ما يعرف بالتسمية الثنائية **Binomial Nomenceature** وفيها أعطي لكل نبات اسمين أحداهما يمثل النوع والآخر الجنس . وقد اعتبرت الأسس المستخدمة لا تمثل العلاقة الطبيعية بين النباتات .

وقد رأي بعض العلماء استخدام صفات أخري بالإضافة للصفات المورفولوجية كالصفات التشريحية وغيرها بدأوا بمحاولة إيجاد بعض العلاقات الطبيعية بين النباتات . من بين هؤلاء .

de Jussieu (1748 – 1836).
de Candolle (1778 – 1841).
Bentham and Hooer (1862 – 83) t / k.

وقبل الانتقال إلي المرحلة الثانية يجدر التوقف قليلاً عند العالم **Charles Darwin** وهو عالم بريطاني قام عام ١٨٣١ بالسفينة المسماة ال **Beagle** برحلة إلي جزر الجالاباجوس التي تبعد حوالي ٦٠٠ ميل من الساحل الغربي لأمريكا الجنوبية حيث قام بدراسة أنواع الكائنات وعلي الأخص الحيوانات الموجودة علي الجزر المختلفة ولاحظ وجود تباين في الكائن الواحد الموجود في عدد من

الجزر ، وعاد إلي انجلترا عام (١٨٣٧) والف كتابه نشؤ الأنواع (١٨٥٩) الذي دون فيه ملاحظاته وابرز أهمخية عملية التطور ودور الانتخابات الطبيعي .

٢- ما بعد داروين :

أدي ظهور كتاب نشؤ الأنواع لداروين ونظرية التطور إلي تغيير جذري في علم التصنيف فبالإضافة إلي الصفات المورفولوجية أضيف مبدأن هامان :

أ- أن النباتات تتأثر بالظروف التي تحيط بها من بيئة ومناخ وعوامل أخري مما يؤدي إلي تطورها .

ب- الأنواع ليست ممثلة بنماذج وإنما بعشائر ومن ثم وضع مبدأ العشائر **Populutions** حيث يتضح وجود الاختلافات عن طريق دراسة العشائر . ولم تعرف طبيعة هذه الاختلافات بدقة إلا بعد ظهور قوانين العالم **Gregor Mendel** في الوراثة .

وتتميز هذه الفترة بدراسات مفصلة لبعض الأجناس التي أخذت في الاعتبار العلاقات التطورية بين النباتات . وكذلك ظهرت الفورات المختلفة وانشئت المعشبات وتصنيف النباتات في كل العالم بعد أن كانت قاصرة علي أوربا وتطور علم التصنيف فأصبح ألان يأخذ في الاعتبار بالإضافة للصفات المورفولوجية نتائج دراسات أخري مثلاً المجموعة الكروموسومية والجينوم ، كمياء النبات ، حبوب اللقاح ، البيئة ، علم الاجنة ، الجغرافيا النباتية والوراثة وغيرها .

من أحدث الاتجاهات في علم التصنيف ما يعرف بال **Molecular Systematics** وفيه تتم دراسة تتابعات القواعد النتروجينية في جزئ المادة الوراثية (**DNA**) . وقد ظهر ان الاختلافات في تتابع القواعد أو إحلال قاعدة مكان أخري يؤدي إلي التباين والاختلافات .

وقد أسهم أختراع الحاسب الآلي في تسهيل مهمة دارس التصنيف وذلك بربط وتحليل النتائج من الدراسات المختلفة وبلورها في أشكال يمكن فيها الاستدلال علي العلاقات بين النباتات من تشابه واختلافات .

وأخيراً فلا يذكر علم التصنيف في مصر إلا باسم أستاذتنا الراحلة فيفي تاكهولم التي أفنت زهرة شبابها ولم تبخل بجهدها بل ومالها من أجل إنشاء معشبة جامعة القاهرة التي تعتبر من أكبر المعشبات في الشرق الأوسط . وتحتوي علي الالآف من الأنواع النباتية هذا بالإضافة لقيامها بتأليف العديد من الكتب التي تعتبر من المراجع الهامة لدارسي الفلورا المصرية . وبالإضافة للأنواع النباتية تذخر المعشبة بالمراجع العلمية في مجال التصنيف والعديد من الفلورات . وبعد رحيلها واصب أستاذنا الكبير

القصاص دعمه للمعشبة ولم يبخل بجهدة وتكاتفت جهوده مع عدد من الدارسين لعلم التصنيف لإثراء المعسبة وازدهارها وأخص بالذكر اثنين هما أ.د. نبيل الحديدي ، أ.د. لطفي بولس مما جعل من المعشبة كعبة لدارسي علي التصنيف .

اساليب الحفاظ على الموارد الطبيعية المتجددة والتنوع البيئى

أ.د. عبد المنعم ماهر على

جامعة أسيوط

للحفاظ على التنوع البيئى فانه يتعين تحديث البيانات الخاصة بما هو متواجد فعلا من الاحياء البرية المتواجدة فى النظم البيئية المختلفة ارضية وبحرية من حيوان أو نبات أو احياء دقيقة .
ويتم اسلوب التعامل بغية الحفاظ على التنوع البيئى فى النظم البيئية على النحو الآتى :

أ. بالنسبة للنظم البيئية الطبيعية فانه يتعين الاهتمام المتواصل بتواجد وعسى بينسى بسين المواطنين والسائحين اختمل تواجدهم بالبيئات المختلفة نحو عدم التعدى او اتلاف تلك النظم تفاديا لغرامات مالية مقابل تلك التلفيات وطبقا للقوانين الموضوعية وذلسك فى اطار الحفاظ على الاحياء او تركيبها المتواجدة فى الاراضى او المجارى المائية وما يتكون على ضفافها ويدخل فى الاطار الطيور البرية المهاجرة او المتعايشة والتى قد تتأثر نتيجة لعمليات الصيد الجائر او استخدام وسائل صيد ضارة وغسير مسسموح باسستخدامها لخطورتها وفى هذا المجال فانه يتعين التعرف على الكثافات السنوية لكل طسير وعلسى اساسها يمكن تحديد الاعداد المسموح بصيدها سنويا دون أن تتأثر لكثافة السنوية بمسا يعمل على انهيار النوع المطلوب حمايته .

ب. بالنسبة للنظم البيئية التى يقيمها العلماء كاسلوب للحفاظ على موارد طبيعية شساملة للمحميات الطبيعية البنوك الوراثية المتطورة بما فيها تلك التى يمكن تواجدها فى المنشأت العلمية والجامعية وكذلك الحدائق النباتية وحدائق الحيوان وما فى حكمها .

هذا بجانب العمل على تبادل الانواع مع الهيئات الاقليمية او الدولية التى يتم الاتفاق علسى التعاون معها وهذه تشمل على السلالات غير المحسنة من النباتات والحيوانات التى بسين ايسدى المزراعين والمنتجين والتى قد تحوى جينات ذات اهمية اقتصادية او حيوية .

ت. بالنسبة للنظم البيئية المتجددة والتى تسمى بالاراضى الجديدة حيث يتعين قبل استغلالها اقتصاديا دراسة الحياة البرية بها لتقدير الانواع التى يستعين حمايتها بالاساليب المتعارف عليها والتى سبق ذكرها باعتبار أن بعضا من تلك الانواع قد يكون اكثر قابلية للاستغلال الاقتصادى حينما يمكسن توفير قدر من العوامل البيئية المناسبة .

هذا ويجد الاشارة الى امكان تطبيق الاسلوب المستحدث للمحميات الطبيعية فى الاراضـــى الجديـــدة حيث يتم الاتفاق مع صاحب المزرعة الجديدة على زراعة نباتات او تربية حيوانات مطلوب حمايتها . بجانب للاستغلال الاقتصادى لها استعانة بالخبراء المختصين

جوانب من مشكلات الموارد الطبيعية فى أفريقيا

أ.د. محمد عبد الغنى سعودى

اعقدنا عن الحديث عن افريقية ومواردها ، أن نقول نالها قارة غنية بمواردها ، وأنـــه لـــولا الاستعمار لكان لافريقية وسكالها شأن آخر ، واذا كان مثل هذا القول قـــد يصـــلح فى الكتابـــات السياسية والحماسية ، فقد يكون بصدا عن الحق والحقيقة من الناحية العلمية الدقيقـــة ، وقـــد رأى الباحث أن يعرض الجوانب من المشكلات البيئية التى تعترض تنمية الموارد الأفريقية لتصحيح المســـار اولا ، ليكون كل جانب موضعا لبحث أو بحوث من المتخصصين فى هذا السبيل ، اذن فهـــى نظـــرة الطائر المحلق ، ودائما نظرة الجغرافى هى .

ليس من شك أن المناخ هو العامل العمدة بين العوامل الحاكمة ، فامتدادة القارة على جانبى خط الاستواء لمسافة ٤١٥٠ كم فى تونس ، ولمسافة ٣٨٦٠كم الى الجنوب من ، ليعطى اصدق تعبير عن مدارية الظروف المناخية ، بهذا الوصع كان ٩٠% من مساحة القارة يضيف مداريا ، وهى اكبر نسبة تحصل عليها قارة من بين القارات وهذا له مثالية التى سيعرض الها البحث بالفصيل .

فإذا انتقلنا لى الارض وجدنا أن افريقية تضم ترجات خصبة فى بعض اجزائها كتربة وادى النيل ، وتربة المرتفعات البركانية كمرتفعات كينيا وكلمنجارو ومبرد ، وتربات الاراض الســـهلية فى اقليم البحر المتوسط . فان كثير من المترفعات الأفريقية تعانى من مشكلات ضحاقمتها وتأكلها واحيانا تماسكها الشديد وبالتاح قدرتها على مقارنة الولات المستخدمة واحيانا قلة قدرتها على الاحتفاظ بالماء ، وقلة المواد العضوية .

واذا انتقلنا لى الحياة النباتية الطبيعية فإن الذى يستدعى النظر هو هاشية استفادة الانســـان من معظمها ، فإذا كان ٢٧% من مساحة القارة يضيف على انه غابات ، فإن النسبة على سبيل المثال لا تمثل سوى يضف مثيلتها فى أن امريكا اللاتينية ، القارة الحيوية المماثلة بل ويـــدخل فيهـــا تلـــك الاشجار التى تخلل اقليم الشقانا ، مما يؤدى الى صعوبة استغلالها الاقتصـــادى ، هـــذا فضـــلا عـــن المشكلات المتعددة فى اشجار غابات الامطار التى تجعل الاستعارة منها اقل من نظرتهـــا فى العـــروض المعتدلة بل وحتى حشانشة الشعانا ذاتها قيمتها الغذائية متدنية عن نظيرتها فى الاقاليم المعتدلة فاذا اضعنا الى هذا وذاك تدخل الانسان باللاوعى للاستفادة من الغابات ادركنا مدى ما يتعرض له هذا المورد من تدهور .

واذا تركنا الموارد النباتية وانتقلنا الى الموارد الحيوية اما اهم المشكلات التى تعترضها ناتجة عن الظروف المناخى ممثلة احيانا فى اجتماع الحرارة المرتفعة مع الرطوبة والمرتفعة بالتالى تنوع وظهور كم ضخم من الحشرات والطفليات التى تسبب الاواض كبرص التدم والملاريا والحمى الصفراء ... فضلا عن أن ذوبابه تسى تسى تحرم الساحات واسعة من القارة من تربية الحيوان للانطاق كبير ، دع تملك الجرازر الاقاليم الصحراوية وشبة الصحراوية ، مما يقتضى تكاليف هائلة لتفاديها . فضـــلا عـــن أن بعضها لا أمل فى القضاء عليه . واذا اضفناها أيضا تدخل الانسان اللامسئول مرة اخرى للاســـتفادة

من هذا المورد الحيوى ، ادراكنا أن صون الطبيعة واجب فى افريقية بشرط أن نقدم للانسان الافريقى البديل لمواجهة متطلباته .

وفى ميدان الموارد المعدنية لا شك تلعب هذه المـوارد ودورا كـبيرا ذا اهميتـه فائقـة فى اقتصاديات القارة سواء جنوب الصحراء او شمالا خاصة فى ميدانى المعادن الاسـتراتيجية او المعـادن النبلية أو الاحجار الكريمة او النفط ، ولكنها تعانى فى كثير من الاحيـان مـن مشـكلات تنقيليـة والتركيب الجيولوجى الذى يؤدى فى احيان كثيره الى التركيز فى اقطار دون اخرى ، وكذلك الموقع الجغرافى السحيق الذى يرفع من تكاليف الاستغلال . هذا بعض مما ستشير الير ورقة البحث .

دور اللجان الوطنية المصرية لبرامج الماب وسكوب والتغير العالمى في أفريقيا

أ.د. محمد عبد الجواد عياد

قسم العلوم البيئية , كلية العلوم ، جامعة الإسكندرية

ملخص

تتمثل ثلاث منظمات وبرامج دولية عن البيئة العالمية ، فى مصر، بثلاث لجان وطنية مصرية، وهـذه البرامج هى :

١- برنامج الإنسان والمحيط الحيوى (الماب) لليونسكو

٢- اللجنة العلمية للمسائل البيئة (سكوب) ، المنبثقة عن "ايكسو" أى المجلس الدولى للاتحادات العلمية ، و

٣- البرنامج الدولى للجيوسفير والبيوسفير (أو التغير العالمى) المنبثق أيضا "ايكسو"

ومنذ نشوء هذه البرامج تمت تغطية أفريقيا بمشروعاتها وأنشطتها . وقد نشطت اللجان الوطنية المصرية للبرامج الثلاث فى أفريقيا . وخاصة فى الأقطار العربية الأفريقية .

وتشمل هذه الانشطة :

- تنظيم المؤتمرات الإقليمية والدورات التدريبية
- تقديم المشورة العلمية
- إنشاء المحميات الطبيعية ، وخاصة محميات المحيط الحيوى
- وإنشاء شبكة عربماب ودعمها
- وتطوير مواقع الأنترنت
- استضافة اجتماعات الخبراء للعديد من المشروعات البحثية .

التوصيات

أولا : توصيات عامة :

١- التوسع في دراسات الموارد المائية والموارد الحيوانية المستأنسة في قسم الموارد الطبيعية

٢- دعم التعليم عن الموارد الطبيعية ودراسة الاتفاقيات العلمية بالجامعات .

٣- الاهتمام بدراسة الثقافات الافريقية بهدف خدمة الأهداف البيئية والوفاء باحتياجات السكان وتشجيع الباحثين لدراسة مجتمعاتهم المحلية والاعتراف بخبرة السكان المحليين ومراجعة خطط التنمية ذات التوجه الغربي .

٤- ضرورة الاهتمام بالمواكبة بين بحثو العلوم الطبيعية والعلوم الانسانية في جال البيئة .

٥- إنشاء محميتين طبعيتين بمنطقة شايب البنات احداهما بالمناطق الجبلية والأخرى بالمناطق الساحلية .

٦- تشجيع دول الخليجح على تشكيل جلان للمشاركة في برنامج الماب وتطوير موقع الانترنت لشبكة عربماب وامداد مجموعة الماب بالمعلومات المتاحة والاقتراحات البناءة من أجل تطوير موقع الشبكة .

٧- العمل من أجل اصدار موسوعات علمية حديثة عن الموارد الطبيعية في مصر لكي تكون امتداد للكتب الرائدة مثل جيولوجية مصر (رشدي سعيد) وشخصية مصر (جمال حمدان) .

٨- بناء قاعدة معلومات متكاملة لتحسين ادارة وتيسير استخدام المعلومات المتوافرة في المجالات المتعددة التي ترتبط بالموارد الطبعية ودعم دور المؤسسات التعليمية والبحثية في صون الموارد الطبيعية والتنمية المستدامة .

٩- اقتناء الادجهزة العلمية المتطورة **Mass spectrometer** والاهتمام بدراسة النظائر المشعة في البيئة .

١٠- الاتجاه لاستخدام المقاومة الحيوية لمقاومة الآفات مثل الفيروسات والمفترسات (مثل العناكب) كاضافة لاساليب المكافحة المتكاملة وموالاة الدراسة لايجاد وسيلة لتربية العناكب باعداد كبيرة وبطريقة مكثفة كعنصر للمكافحة المتكاملة للآفات .

١١- دراسة أثار السدود على ملوحة المياه المختزنة امامها وتلوث النيل والبحيرات ونقص الثروة السمكية وخصوبة التربة وارتفاع مستوى الماء الأرضي والاضرار التي تلحق بالمباني الاثرية.

١٢- دراسة العلاقة بين التغيرات المناخية والتاريخية في افريقيا .

١٣- اعلان بحيرة السد العالي محميةطبيعية باعبارها خزان الماء الطبيعي لمصر وعمل استراتيجية وطنية لتطهير وتنقية مياه البحيرات الشمالية والوسطى من التلوث وكذلك نهر النيل مع تشجيع البحوث التطبيقية لتنقية المياه بيولوجيا وذلك للحفاظ على الثروة السمكية وتنميتها وتعاون دول حوض النيل في الدراسات السمكية وتبادل الخبرات .

١٤- ضرورة عمل تقييم للمحمات الطبيعية كل فترة وتحديد حجم السياحة فيها حفاظا على الثروات الطبيعية .

١٥- يوصي المجتمعون بعقد هذه الندوة بصفة دورية كل عام أو عامين والتوسع بمشاركة العلماء الأفارقة وغيرهم من المهتمين بالشئون الافريقية.

ثانياً : الموارد الأرضية والجوية والمالية :

١- يوصي بوضع نظام دقيق ومنتظم لرصد تدهور الأراضي والسيطرة عليها ووضع التقديرات والاستراتيجيات بعيدة المدى في قياس تدهور الأراضي وضرورة تطوير خرائط حصر التربة وتحديثها بصفة مستمرة مع تطوير استخدام نظم المعلومات الكغرافية واستخدام الاستشعار عن بعد .

٢- استخدام اساليب متعددة لعمل خرائط تربة تفصيلية لمنطقة الاستزراع والاسكان في الصحارى المصرية وتكثيف للنتائج وةاعلان الجمهور والمستثمرين لها .

٣- معالجة زحف الرمال المتحركة في ساحل المتوسط باستخدام النباتات المحلية في المنطقة .

٤- ضرورة تبني الدولة لبرنامج وطني للتغيرات المناخصية وكل مايتم من أبحاث علمية عن هذه المتغيرات الحيوية وعلاقتها بالتغير في كميات الأمطار ومشاركة دول حوض النيل مع مصر في برنامج اقليمي بالنسبة لحوض النيل .

٥- تجميع الدراسات، والأبحاث وحديد المردودات المختلفة لكل التغيرات المناخية المتوقعة على حوض نهر النيل .

٦- إنشاء برنامج قومي في مصر وكذلك اقليمي لدول حوض نهر النيل وهذا البرنامج يختص بدراسة جميع العوامل والتغيرات المناخية ـ توزيع المحاصيل ـ تغير في مياه النيل ـ الأمراض النباتية ـ تركيب المحصول ـ المقننات المالية .

٧- عمل نموذج رياضي للتنبؤ طويل الامد لتصرفات نهر النيل عند أسوان وذلك لمحاولة تحسين القدرة التنبؤية لفيضانات النيل .

٨- توقع حدوث فترة جفاف في خلال سنة ٢٠٠٥ في منطقة هضبة البحيرات وبالتالي في مصر ولذا يوصى بعمل الاحتياطات اللازمة لمواجهة تلك الفترة .

٩- استخدام ابراج التبريد الطبيعي المناسبة لمنطقة توشكى بعد الدراسة المتكامل وتطويرها تحت الظروف المناخية السائدة وتوصي وزارتي الري والتعمير بعمل الدراسات اللازمة لتعمير توشكى من خلال مشروع قومي .

ثالثاً : الموارد النباتية والحيوانية :

١- ضرورة الاستفادة من البرنامج الاستراتيجي الذي وضعته **FAO** لمكافحة الأمراض الحيوانية في القارة الافريقية .
٢- عند استخدام اساليب تشميس التربة وتعقيمها كبديل لاستخدام المبيدات الكيمائية مراعاة عدم الاضرار بالانواع غير المستهدفة وخاصة الانواع المفيدة للمقاومة البيولوجية .
٣- العناية بالمحافظة على الأنواع البرية المتوطنة نباتية وحيوانية وبالأخص الأنواع النادرة والتي يتهددها التدهور والانقراض ونوصي الجهات الحكومية المسئولة بوضع التشريعات التي تجرم استنزاف الموارد البرية نباتية أو حيوانية بالاستغلال الجائر الذي يجاوز قدرتها على التجدد.
٤- دعم تنفيذ بنود الاستراتيجية القومية لصون الموارد الطبيعية النباتية والحيوانية والخاصة بانشاء البنك القومي للجينات ومركز لحفظ الاصول الوراثية وتعدد افرعه في سائر المناطق المصرية للجروع اليها عند الحاجة اليها كمجموعات مرجعية وبنوك الجينات وانشاء بنوك بذور في المحميات الطبيعية .
٥- وضع التشريعات والقوانين لتسجيل ملكية الثروات البيولوجية المحلية والحفاظ عليها وعدم السماح بتداولها مع الجهات او الافراد الجانب الا من خلال القنوات الشرعية استعدادا لتطبيق قانون حماية الملكية الفكرية بعد انتهاء فترة السماح الممنوحة للدول النامية .
٦- انشاء مركز لتصنيف الفطريات في مصر وافريقيا ينشأ في رحاب جامعة القاهرةوذلك للتعرف على مسببات امراض وآفات المحاصيل الزراعية القابلة للتصدير بالاضافة الى التنوع البيولوجي لفطريات التربة التي تستخرج منها المضادات الحيوية ذات الأهمية العضوى في الطب والعلاج التي تمثل ثروة كبيرة للعلوم الطبية والبيطرية .

Olasantan, F. O. (1988). Intercropping of cassava (Manihot esculenta) with maize or cowpea under different row arrangements. Field Crop Res. 19 (1): 41- 50 (C. F. Field Crop Abst. 41: 9215).

Oliviera, H. F.; Andrade, W. E. B.; Oliveira, L. A. A.; Freitas, O. H.; Bastos, A. and De- Oliveira, L. A. A. (1990). Length of cassava roots under different intercropping systems with maize. Comunicado Tecnico Empresa de pesquisa Agropecuaria do Estado do Rio de Janeiro 204: 1- 4. (C. F. Field Crop Abst. 43: 9031).

Payne, H. and Webster, D. C. (1956). The toxicity of cassava varieties on two Jamaican soil types differing potassium status. Kingston, Jamaica, Ministry of Agriculture and Fisheries. Crop Agronomy Division. 3p.

Sheela, K. R; Devi, L. G.; Pillai, G. R; Kumar, A. S. A; and Swadijia, O. K. (1996). Planting geometry and nutrient management studies in cassava-fodder cowpea intercropping system. College of Agriculture, Vellayani 695 522, Kerala, India. Journal- of- Root- Crops. 1996, 22: 1, 18- 22 (C. F. The Commonwealth Agricultural Bureaux Abstracts, Dialog File No. 98- 0700156) .

Silva, K. P. De (1982). Cassava (Manihot esculenta Crantz)- legume intercropping system: crop yield under varying spatial arrangement of legumes [Phaseous aureus L.; vigna sinensis L. and Glycine max L. ; study conducted in the Philippines]. College, Laguna (philippines). Feb 1982. (C. F. The Commonwealth Agricultural Bureaux Abstracts, Dialog File No. 83- 881631) .

Willey, R. W. (1979-a).Intercropping. its importance and research needs. Part I: competition and yield advantages. Field Crop Abst., 32: 1-10

REFRENCES

Ahit, O. P.; Apit S. E. and Pasas M. B. (1981). Growth and development of cassava under the traditional and Mukibat systemof planting in the philippines. Annals of Tropical Research, 3 (3): 187-198

Asher, C. J. ; Edwardds. D. G. and Howeler, R. H. (1980). Nutritional disorders of cassava (manihot esculenta Grantz). St. Lucia, Australia, University of Queensland. 48p.

Cassman, K. G., Whiteny A. S. and Fox R. L. (1981). Phosphorus requirements of soybean and cowpea as affected by mode of nutrition Agron. J., 73(1) : 17- 22

Correa, H. ; Rccha, B. V. de; Tanaka, R. T.; Rada, A. M. S. and Guedes, G. A. A. (1981). Study of different levels of N, P and K in the cultivation of cassava on a dark red latosol. Gruz des Almas, brazil ; Dept de Inf. Docum : 325- 330.

Edwards, D. G.; Asher, C. J. and Wilson, G. L. (1977). Mineral nutrition of cassava and adaptation to low fertility conditions. In Symposium of the International Society for Tropical Roct Crops, 4th., Cali, Colombia, 1976. Proceedings. Ottawa, Canada, International Development Research Centre. Pp. 124- 130.

Gaballah, E. B. (1991). Effect of some agricultural practices on growth and yield productivity of cassava. M. Sc. Thesis, Fac. Agric. Suez Canal Univ.

Hewitt, E. J. (1963). The essential nutrient elements; requirements and interactions in plants. In F. C. Steward (ed.), Plant Physiology. Academic Press, New York. 3 : p 137.

Katunzi, A. L.; Teri, J. M.; Sibugo, K. P. and Misangu, R. N. (1987). The effect of intercropping and fertilizer application on Bean diseases and yield proceedings of the sixth Bean ResearchWorkshop, Sokoine univ. of Agric., Morogoro, Tanzania p. 66.

Khalil, A. A. M. (1995). Agronomic studies on cassava plant Ph. D. Thesis Fac. Agric. Zagazig, Zagazig University

Mason, S. C.; Leihner, D. E. and Vorst J. J. (1986). Cassava - cowpea and cassava-peanut intercropping I. yield and land use efficiency Agron. J. 78(1): 43- 46.

Mc Gilchrist, C. A. (1965). Analysis of competition experiments. Biometrics, 21: 975- 985.

Muniarti, and Siregar, C. A. (1989). The effect of TSP application on cassava intercropped in Leucaena plantation.Bulletin- Penelitian - Hutan (Indonesia). Forest Research Bulletin. (1989). (no. 506) p. 1- 10 (C. F.The Commonwealth Agricultural Bureaux Abstracts).

Nair, P. G. and Aiyer, R. S. (1985). Effect of potassium nutrition of cassava (1) Growth yield components and yield. J. of Root Crops11(1- 2) : 23- 28.

Okolib, O. O ; Hossain, M. A; Kissiedu, A. F. K; and Asare- Bediako, A. (1996). Effect of planting dates and growth habits of cassava and cowpea on their yield and compatibility.National Root Crops Research Institute, P. M. B. 7006, Umuahia, Nigeria. Tropical Agriculture. 1996, 73: 3, 169- 174. (C. F. The Commonwealth Agricultural Bureaux Abstracts, Dialog File No. 97- 0707050) .

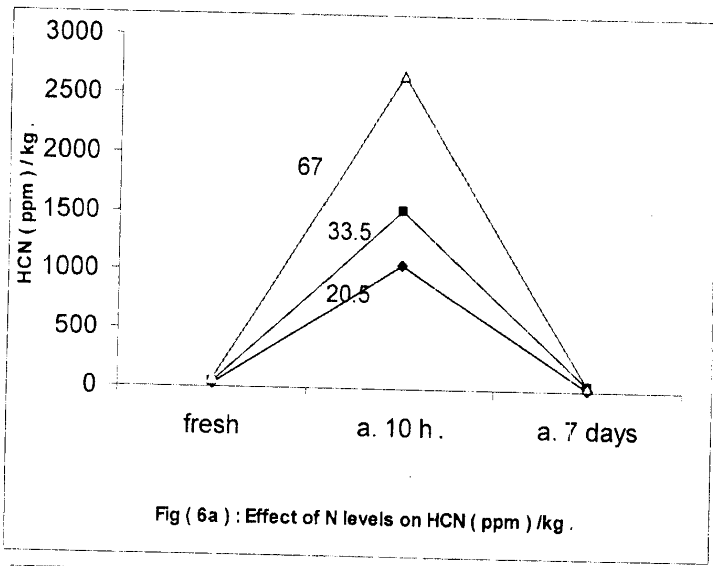


Fig (6a) : Effect of N levels on HCN (ppm) /kg .

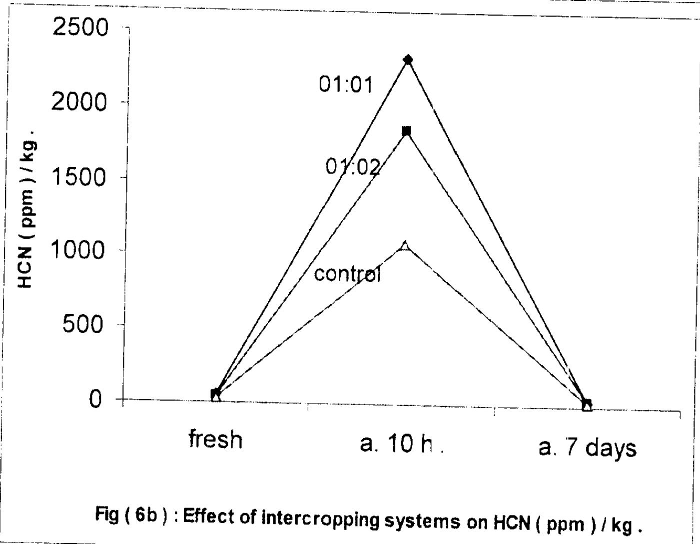


Fig (6b) : Effect of intercropping systems on HCN (ppm) / kg .

Fig (6): Effect of N levels and intercropping systems on HCN (ppm)/ kg 1999/2000

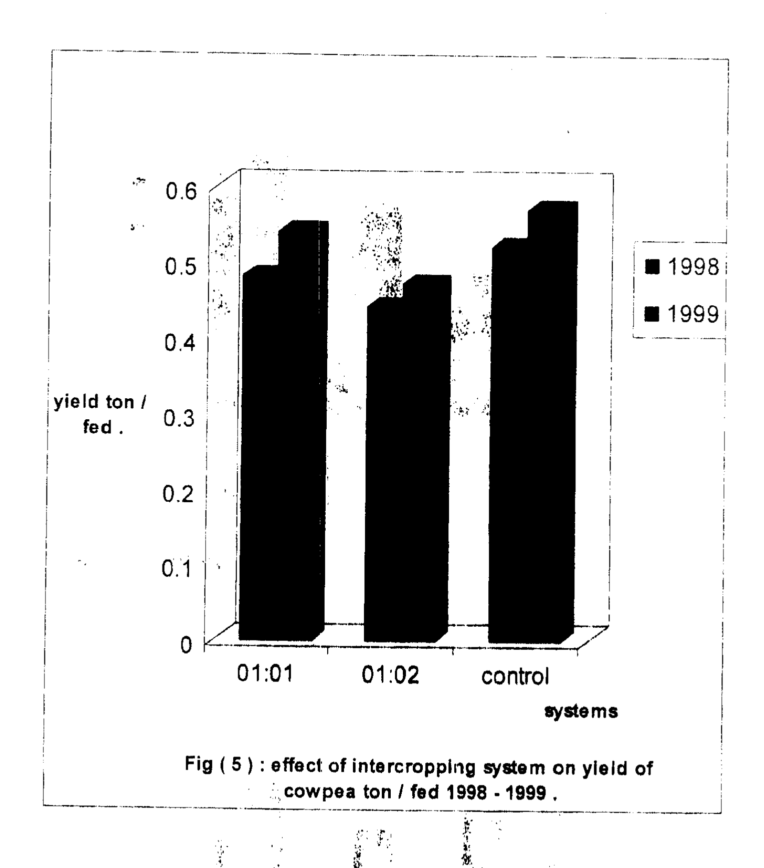


Fig (5) : effect of intercropping system on yield of cowpea ton / fed 1998 - 1999 .

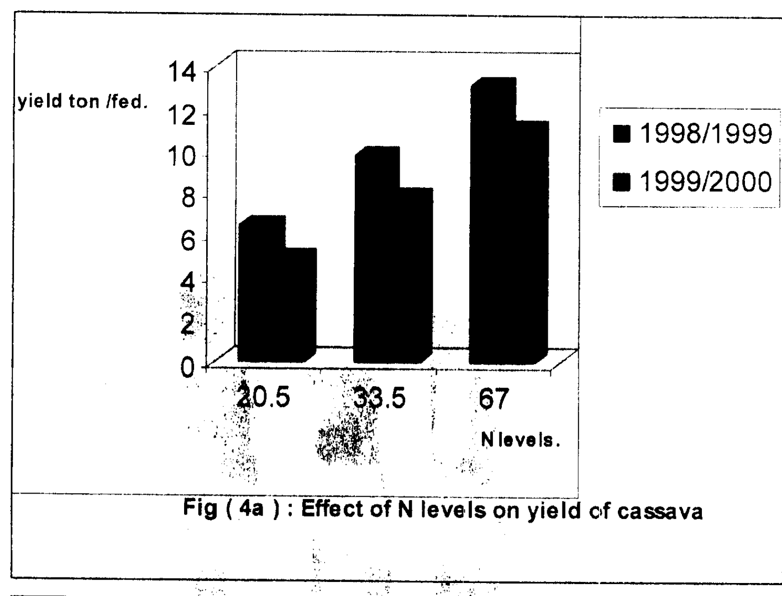


Fig (4a) : Effect of N levels on yield of cassava

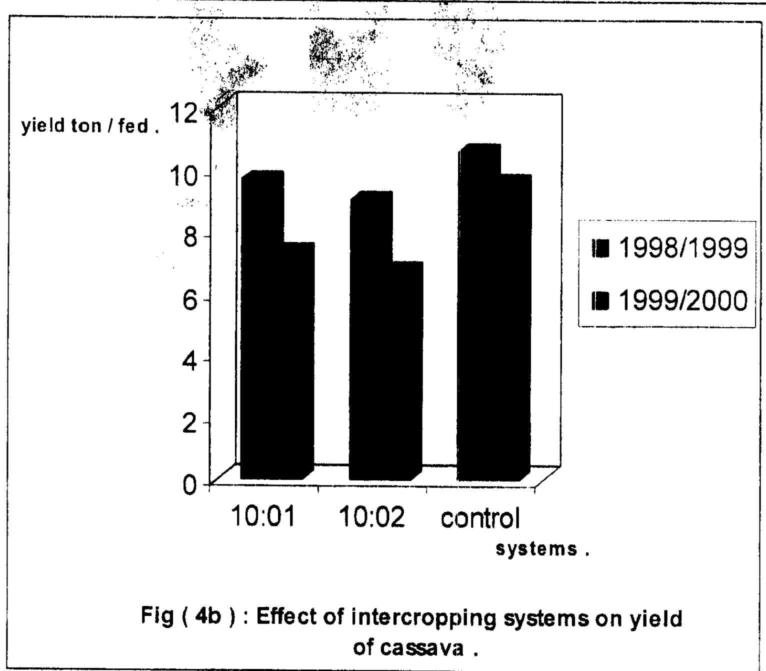


Fig (4b) : Effect of intercropping systems on yield of cassava .

Fig (4): Effect of N levels and intercropping systems on yield of cassava ton / fed. 1998/99 – 1999/2000.

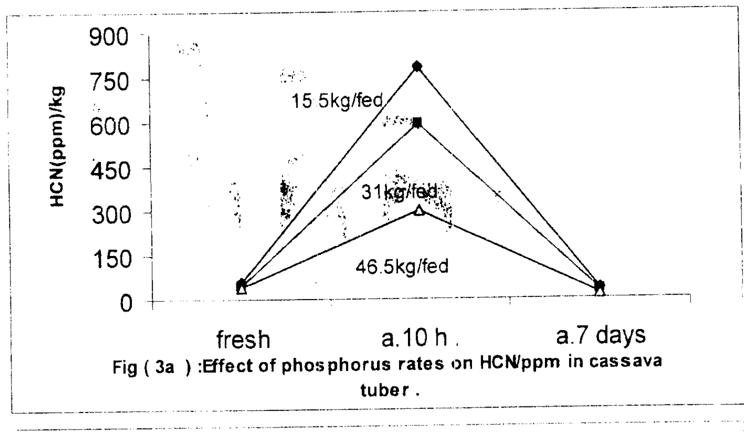


Fig (3a) :Effect of phosphorus rates on HCN/ppm in cassava tuber .

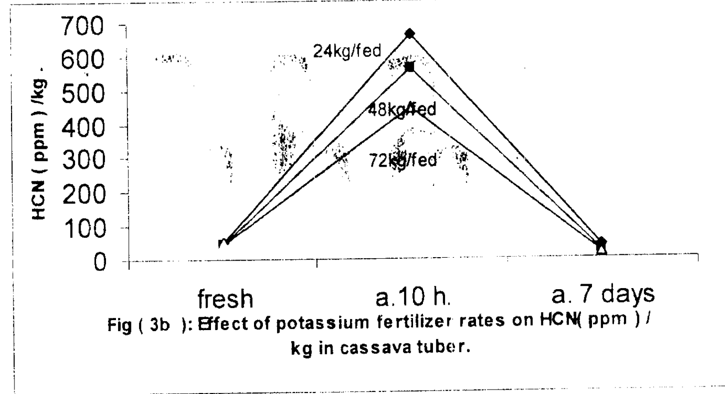


Fig (3b): Effect of potassium fertilizer rates on HCN(ppm) / kg in cassava tuber.

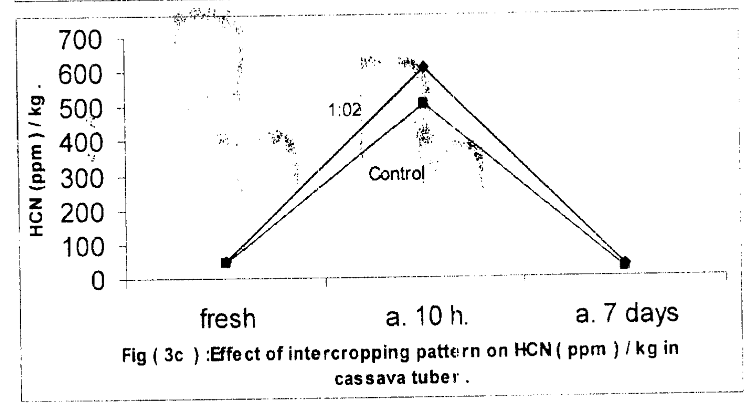


Fig (3c) :Effect of intercropping pattern on HCN (ppm) / kg in cassava tuber .

Fig (3): Effect of phosphorus, potassium rates and intercropping pattern on HCN contents in cassava tuber 1999/ 2000.

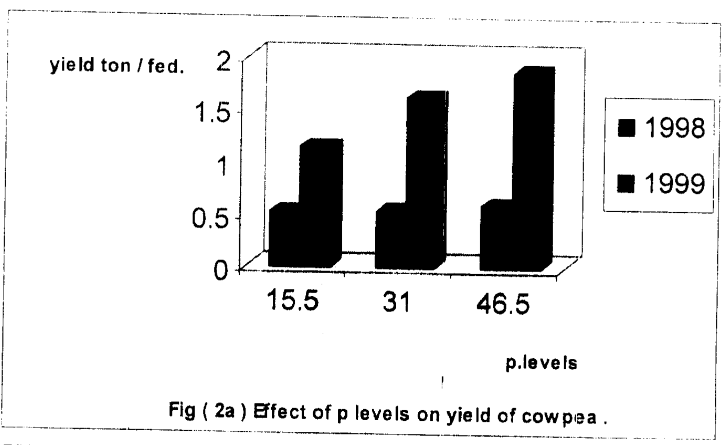


Fig (2a) Effect of p levels on yield of cowpea .

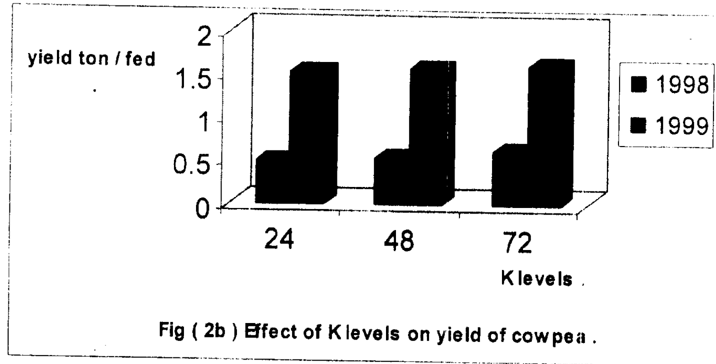


Fig (2b) Effect of K levels on yield of cowpea .

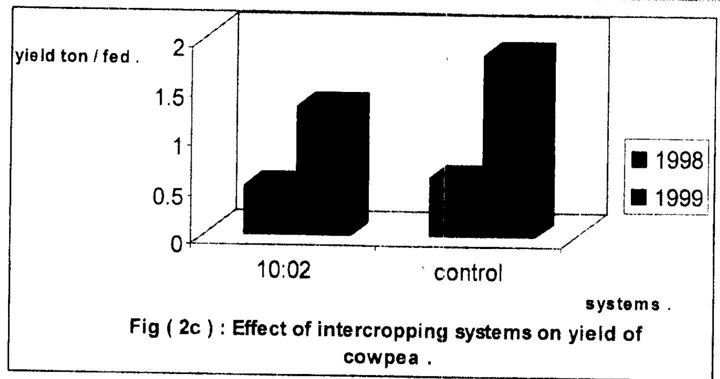


Fig (2c) : Effect of intercropping systems on yield of cowpea .

Fig (2): Effect of p levels, k levels and intercropping systems on yield of cowpea ton / fed 1998 – 1999

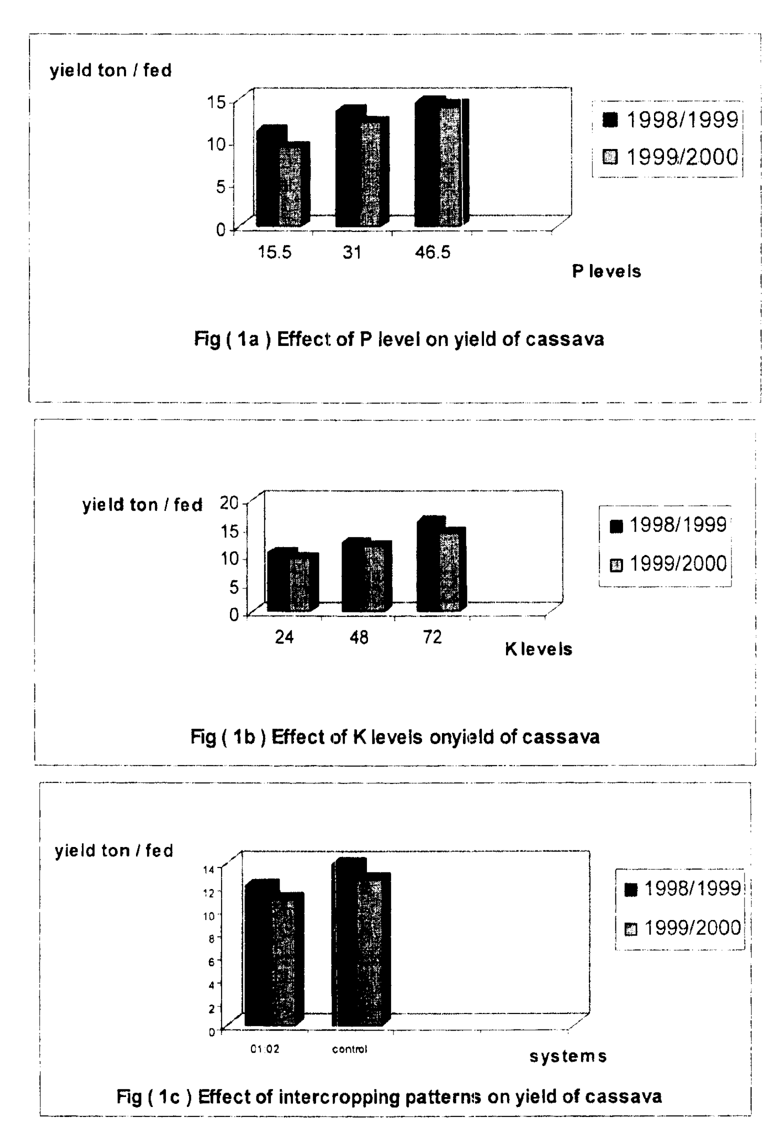


Fig (1a) Effect of P level on yield of cassava

Fig (1b) Effect of K levels onyield of cassava

Fig (1c) Effect of intercropping patterns on yield of cassava

Fig (1): effect of p level, k level and intercropping patterns on yield of cassava. ton / fed 1998/ 99 - 1999 / 2000

Table (16):- Effect of phosphorus fertilizer rates on HCN/ ppm in cassava tubers 1999/ 2000

P levels Kg/ fed	**fresh**	**After 10 hours**	**After 7 days**
15.50	56.117	781.750	37.250
31.00	44.667	593.750	30.283
46.50	38.575	301.833	19.575
LSD 5%	2.283	19.77	2.181

Table (17):- Effect of potassium fertilizer rates on HCN/ ppm in cassava tubers 1999/ 2000

K levels Kg/ fed	fresh	After 10 hours	After 7 days
24.00	50.442	664.750	42.467
48.00	46.050	562.667	24.150
72.00	42.867	449.917	20.492
LSD 5%	2.283	19.77	2.181

Table (18):- Effect of intercropping pattern on HCN/ ppm in cassava tubers 1999/ 2000

Systems	**fresh**	**After 10 hours**	**After 7 days**
1:2	48.394	611.00	32.544
Control	44.511	507.222	25.528
LSD 5%	1.864	16.14	1.781

Table (14):- Effect of potassium fertilizer rates on some chemical content in seeds and leaves of cowpea intercropped with cassava 1998-1999

K 20kg / fed	N% Leaves	Seeds	Protein% Leaves	Seeds	P% Leaves	Seeds	K% Leaves	Seeds
				1998				
24.00	0.601	1.228	3.758	8.022	0.157	0.223	0.970	0.678
48.00	0.664	1.328	4.082	8.301	0.169	0.235	1.088	0.852
72.00	0.617	1.240	3.855	7.748	0.162	0.222	1.308	1.005
LSD 5%	N. S	N. S	N. S	N. S	N. S	N. S	0.113	0.111
			1999					
24.00	0.672	1.406	4.198	8.787	0.191	0.320	0.991	0.789
48.00	0.726	1.477	4.536	9.234	0.204	0.334	1.107	0.917
72.00	0.665	1.330	4.155	8.315	0.191	0.358	1.337	1.098
LSD 5%	N. S	N. S	N. S	N. S	N. S	N. S	0.101	0.101

Table (15):- Effect of intercropping patterns on some chemical content in seeds and leaves of cowpea intercropped with cassava 1998-1999

Systems	N% Leaves	Seeds	Protein% Leaves	Seeds	P% Leaf	Seeds	K% Leaves	Seeds
				1998				
1:2	0.680	1.363	4.250	8.749	0.197	0.272	1.156	1.003
Control	0.575	1.168	3.548	7.298	0.128	0.181	1.088	0.688
LSD 5%	0.058	0.119	0.353	0.678	0.046	0.055	N. S	0.091
				1999				
1:2	0.748	1.534	4.673	9.587	0.229	0.408	1.177	1.068
Control	0.627	1.275	3.920	7.970	0.161	0.267	1.113	0.801
LSD 5%	0.058	0.129	0.353	0.810	0.049	0.049	N. S	0.082

6-Effect of phosphorus and potassium fertilizer rates on HCN in cassava tubers intercropped with cowpea.

6-1-Effect of phosphorus and potassium fertilizer rates on HCN in cassava tuber intercropped with cowpea.

Data presented in Tables (16 and 17) revealed that there were significant reductions in HCN content in tuber tissues with increasing the rate of phosphorus application up to the heaviest rate(46.50 kg P_2O_5/ fed.).These trends were observed when analysis was conducted on fresh, after 10 hours or after 7 days. The data also evidenced that HCN concentrations started low when analyzed fresh, then increased to maximum after 10 hours and then declined to minimum after 7 days. These results were also supported by Khalil (1995) Resemblance to the effect of phosphorus fertilizer rate was the effect of potassium fertilizer. The more the applied potassic fertilizer rate was, the less HCN content was found in tuber tissues up to the heaviest rate (72 kg k_2O/ fed.). These trends were also observed when analysis were undertaken, on fresh, after 10 hours and after 7 days with a trend similar to the effect of phosphorus. These results were supported by Payne and Webster (1956) .

6-3-Effect of intercropping on HCN in cassava tubers intercropped with cowpea.

Data presented in Table (18) indicated that HCN in cassava tubers grown in pure stand was always lower than those recorded in tuber tissues of intercropped cassava. On other hand, highest contents of HCN were observed when cassava was analysed after 10 hours then decreased after 7 days. Tese results were also true whether cassava was intercropped or grown in pure stand.

Table (13):- Effect of phosphorus fertilizer rates on some chemical content in seeds and leaves of cowpea intercropped with cassava 1998-1999

				1998				
P 2^05 kg / fed	**N% Leaves**	**Seeds**	**Protein% Leaves**	**Seeds**	**P% Leaves**	**Seeds**	**K% Leaves**	**Seeds**
15.50	0.609	1.217	3.804	7.955	0.110	0.172	0.899	0.718
31.00	0.646	1.295	3.968	8.093	0.169	0.253	1.180	0.803
46.50	0.628	1.284	3.924	8.023	0.209	0.255	1.289	1.015
LSD 5%	N. S	N. S	N. S	N. S	0.057	N. S	0.113	0.111
				1999				
15.50	0.685	1.404	4.281	8.775	0.137	0.213	0.923	0.777
31.00	0.702	1.420	4.390	8.878	0.206	0.356	1.198	0.896
46.50	0.675	1.389	4.218	8.682	0.246	0.443	1.313	1.131
LSD 5%	N. S	N. S	N. S	N. S	0.061	0.061	0.109	0.101

Table (12):- Effect of intercropping patterns on some chemical concentrations in tubers and leaves of cassava intercropped with cowpea 1998/ 1999 - 1999/ 2000

Systems	N% Leaves	Tubers	Protein % Leaves	Tubers	P% Leaves	Tubers	K% Leaves	Tubers
1998/1999								
1.2	1.827	0 417	1.412	2.585	0.358	0.410	1.135	1.043
Control	1.419	0.279	8.867	1.747	0.252	0.257	0.832	0.800
LSD5%	0.186	0 025	1.164	0.188	0.049		0.099	0.094
1999/2000								
1:2	2 946	0 771	18.413	4.818	0.406	0.537	1.163	1.084
Control	2 31	0.579	14.438	3.619	0.307	0.327	0.863	0.835
LSD5%	0.237	0.078	1.481	0.489	0.049	0.043	0.101	0.091

and potassium concentrations in leaves and seed tissues were more responsive to increasing phosphorus fertilizer rates. Positive responses were observed up to the heaviest doses (46.50 kg P_20_5 / fed.). Supporting the results of Hewit (1963) who explained that nitrogen requirement are almost dependent on bio-supply of bacteria, but , legumes is in need of copious supply of phosphorus and potassium essential for protein synthesis. Seeds were much higher in nitrogen, protein and phosphorus concentrations than in leaves. On the contrary, leaf potassium was relatively higher than seeds. The importance of nitrogen and phosphorus in protein synthesis was the cause and effect.

5-2-Effect of potassium fertilization rates on some chemical concentrations of cowpea leaves and seeds

Data in Table (14) revealed that the effect of potassium fertilizer rate on the chemical concentrations of cowpea leaves and seeds was less pronounced than that of phosphorus. Significancy only occurred on leaf and seeds potassium. Nitrogen and protein tended to increase with increasing potassium fertilizer rate up to the medium (48 kg k_20) indicating that this rate was adequate for optimum requirement. Phosphorus concentration response to potassium fertilizer rate was similar to nitrogen concentration response. However, data indicated that as potassium fertilizer rate increased potassium concentrations of leaves and seeds significantly increased up to the heaviest rate(72 kg k_20 /fed.).

5-3-Effect of intercropping on chemical analysis of leaves and seeds of cowpea plants

The data presented in Table (15) revealed that nitrogen, protein , phosphorus and potassium concentrations in the tissues of leaves and seeds of cowpea plants intercropped with cassava were ever superior to those of plants grown in pure stand. It is interesting to conclude that intercropping had a favourable effect on the nutritive values of leaves, since, intercropping enhanced protein synthesis, as well as increased all other minerals. Supporting the results of Khalil (1995).

5-Effect of phosphorus and potassium fertilizer rates on some chemical concentrations of cowpea leaves and seeds

5-1-Effect of phosphorus fertilizer rates on some chemical concentrations of cowpea leaves and seeds

Data presented in Table (13) revealed that increasing phosphorus fertilizer rates was associated with increasing leaf and seed nitrogen and protein up to the medium level(46.5 kg P_2O_5), although the increases were not significant. The data also evidenced that proteins in the seeds were one fold higher than leaves. On the other hand, phosphorus

Table (10):-Effect of P levels on some chemical concentrations in tubers and leaves of cassava intercropped with cowpea1998/1999

P_2O_5 kg/fed	N% Leaves	Tubers	Protein% Leaves	Tubers	P% Leaves	Tubers	K% Leaf	Tubers
1998/ 999								
15.50	1.403	0.279	8.756	1.741	0.192	0.163	0.896	0.918
31.00	1.654	0.427	10.335	2.668	0.264	0.361	0.971	0.955
46.50	1.812	0.340	11.327	2.088	0.459	0.478	1.085	0.892
LSD 5%	0.228	0.030	1.425	0.231	0.061	0.057	N. S	N. S
1999/2000								
15.50	2.553	0.651	15.958	4.138	0.228	0.271	0.934	0.953
31.00	2.843	0.749	17.424	4.683	0.302	0.457	0.995	0.998
46.50	2.669	0.625	16.683	3.908	0.539	0.569	.111	0.928
LSD 5%		N. S	N. S	N. S	0.061	0.052	N. S	N. S

Table (11):- Effect of K levels on some chemical concentrations in tubers and leaves of cassava intercropped with cowpea 1998/1999

K_2O kg/ fed	N% Leaves	Tubers	Protein % Leaves	Tubers	P% Leaves	Tubers	K% Leaves	Tubers
1998/1999								
24.00	1.399	0.296	8.751	1.852	0.326	0.302	0.783	0.740
48.00	1.608	0.318	10.036	1.956	0.300	0.365	0.987	0.928
72.00	1.861	0.430	11.630	2.690	0.289	0.335	1.181	1.098
LSD5%	0.228	0.030	1.425	0.231	N. S	N. S	0.121	0.115
1999/2000								
24.00	2.530	0.622	15.815	3.954	0.380	0.394	0.822	0.781
48.00	2.681	0.605	16.407	3.781	0.354	0.454	1.014	0.967
72.00	2.855	0.799	17.843	4.993	0.335	0.448	1.203	1.131
LSD5%	N. S	0.096	N. S	0.599	N. S	N. S	0.123	0.111

4-Effect of phosphorus and potassium fertilizer rates on some chemical concentrations of cassava leaves and tubers intercropped with cowpea

4-1-Effect of phosphorus fertilizer rates on the chemical concentrations of cassava leaves and tubers.

Data in Table (10) revealed that increasing phosphorus fertilizer rates resulted in gradual increases in nitrogen and protein concentrations in cassava leaves and tubers up to the heaviest rate , i- e, 46.50 kg / fed. The data revealed that there were gradual and consistent increases in phosphorus concentrations in leaves and tubers of cassava with increasing phosphorus fertilizer rate up to the heaviest (46.5 kg /fed). The data also evidenced that unlike, nitrogen and protein, phosphorus concentrations in leaves were in all cases higher in tuber than in leaves, except, in case of lowest rate in the first season. These results emphasized the importance of phosphorus in tuber formation and bulking. On other hand, data revealed that there were no relevance between increasing the rate of phosphorus and potassium concentrations in both tubers and leaves tissues.

4-2-Effect of potassium fertilization rates on some chemical concentrations of cassava leaves and tubers.

Data presented in Table (11) revealed that positive effects were indicated when increasing potassium fertilizer rate on nitrogen and protein contents in the leaves and tubers tissues of cassava plants. These results indicate that increasing potassium fertilizer level increased the nutritive value of both cassava leaves and cassava tubers as feed and food crop. The data also revealed that neither a consistent trend nor any significant differences among the treatments were observed. Nevertheless, the antagonistic effect of increasing potassium fertilizer level and phosphorus concentrations was observed. The data also evidenced that there were consistent and gradual increases in potassium concentrations of both tubers and leaves of cassava with increasing potassium fertilizer levels up to the heaviest rate, i. e, 72 kg $k_2 0$ / fed. Supporting the results of Khalil (1995).

4-3-Effect of intercropping on some chemical analysis of cassava leaves and tubers.

Data in Table (12) revealed that intercropping significantly increased leaf and tuber nitrogen and protein concentrations. These results were true in both seasons, and were in agreements with those obtained by Hewit (1963). who concluded that these increases might be due to more nutrients utilization by plants grown soley, since there was more plant density per unit area of land. Phosphorus and potassium concentrations in the leaves and tubers tissues of cassava plants intercropped with cowpea was significantly higher than those grown in pure stand in both seasons. The data also evidenced that all values in 1999 season were higher than the respective values in 1998 season probably due to the residual effect of the previous fertilization practiced in the previous season.

seemed plansible, since cassava had a relatively huge vigor as compared with cowpea plants. The data also revealed that aggressivity indicated slight inter competition forces, since their values were not appreciable in both seasons due to differences in morphological characters and the nature of both components in the association which render them in mutual benefit rather than incompatible companion crops.

Data on the exact degree of competition, i. e, the competitive ratio (CR), indicated that cassava was always more competitive than cowpea in both seasons. CR values of cassava were ever higher than the unit, whereas, CR values of cowpea were ever below the unit. This tendency could be interpreted due to the higher growth vigor of cassava than cowpea and also to the delayed timing of planting cowpea after cassava by 50 and 66 days in both seasons, respectively.

Table (8):- Effect of intercropping patterns on growth characters and yield of cowpea intercropped with cassava 1998- 1999

Sys.	Plant heigt cm.	No. of branch / p.	No. of pods / p.	W. of pods kg/ p	W. of seeds kg/ p	W. of 100 seeds /g	Yield of pods ton/fed	Yield of seeds ton/fed
1998								
1:2	31.94	25.30	16.87	2.64	1.32	21.03	0.98	0.503
Cont.	31.29	27.90	17.52	2.97	1.52	22.06	1.22	0.586
LSD 5%	N. S	0.93	N. S	0.83	N. S	N. S	0.09	0.07
1999								
1:2	27.72	2.90	25.46	0.49	0.261	21.663	1.530	1.303
Cont.	25.63	3.17	30.49	0.70	0.395	22.850	2.090	1.840
LSD 5%	0.42	0.04	0.03	1.33	0.02	0.88	0.31	0.14

Table (9) :-Competitive relationship between cassava and cowpea under cropping systems 1998 /1999-1999 / 2000.

Systems	Relative yield Cassava	Relative yield Cowpea	LER	RCC Cassava	RCC Cowpea	RCC Total	Agg Cassava	Agg Cowpea	CR cassava	CR cowpea
1998/ 1999										
1:2	0.86	0.85	1.71	12.69	4.49	56.98	+0.013	-0.013	2.024	0.494
1999 / 2000										
1:2	0.87	0.71	1.58	12.96	1.21	15.68	+0.015	-0.015	2.450	0.407

Table (7):- Fertilizer utilization rate of potassic fertilizer.

	Phosphatic fertilizer			Potassic fertilizer		
Year	**Rate of fert.**	**Pods ton /fed**	**Seeds ton/ fed**	**Rate of fert.**	**Pods ton./fed**	**Seeds ton./fed**
	15.50			24.00		
1998 1999		4.51 22.26	2.25 23.55		4.83 9.35	1.61 0.32
	31.00			48.00		
1998 1999		7.10 15.48	3.87 16.13		7.04 9.03	1.93 ------
	46.50			72.00		

of utilization was observed in the second season to reach nil in case of weight of seeds / fed .The data also evidenced that the rate of utiliziting phosphatic fertilizer followed the same course of change but exceeded that of potassic fertilizer. The more response to fertilize with phosphorus rather than potassium was due to leguminous nature towards phosphorus rather than potassium.

2-4-Effect of intercropping on growth characters, yield and yield components of cowpea intercropped with cassava

Data in Table (8) revealed that cowpea height was not influenced by intercropping. On other hand, intercropping significantly diminished the average number of branches /plant. The data also evidenced that values of all yield components of the intercropped cowpea plants were ever lower than those recorded for pure stand plants. The data also indicated that the yield of pods /fed. as well as the yield of seeds /fed. followed also the same trand. Yields of cowpea plants grown in pure stand were superior to those of intercropped cowpea. These results were in harmony with those obtained by Katunzi et al (1987).

3-Competitive relationships and yield advantages of intercropping cassava with cowpea.

Data in Table (9) revealed that intercropping cassava with cowpea achieved yield advantages in both seasons, although yields of both components in the intercrop decreased due to intercropping. Land equivalent ratio recorded 1.71 and 1.58 in 1998 and 1999 seasons, respectively. Land use efficiency exceeded 50% in both seasons (being 71 and 58%). These results are in agreement with those obtained by Mason et al (1986), and Olasantan (1988). The high land use efficiency of the intercrop could be due to (a) low competition between cassava and cowpea, since, both components were raised on separate ridges (b) the intercrop includes two species one of which is leguminous which probably has a mutual beneficial effect with cassava plants. The relative crowding coefficient followed the same course of change as the land equivalent ratio. All values of RCC indicated yield advantage due to intercropping. All K values for cassava and cowpea surpassed the unit. Aggressivity in the associations indicated that cassava was always the dominant component whereas, cowpea was the dominated. These results

Table (5):- Effect of P rates on growth characters and yield of cowpea intercropped with cassava 1998- 1999

P_2O_5 kg/ fed	Plant height cm.	No. of branch / p.	No. of pods / p.	W.of pods kg/ p	W. of seeds kg/ p	W.of 100 seeds /g	Yield of pods ton/fed	A. E. rate	Yield of seeds ton/fed	A. E. rate
1998										
15.5	30.61	2.41	16.97	0.30	0.13	22.12	1.04	0.0045	0.515	0.0024
31.0	31.46	2.98	19.03	0.31	0.15	23.06	1.07	0.0073	0.531	0.0038
46.5	32.79	3.48	21.31	0.33	0.16	24.33	1.18		0.590	
LSD 5%	0.53	0.11	0.03	N. S	N. S	1.18	0.11		N. S	
1999										
15.5	25.25	2.46	23.33	0.43	0.288	20.61	1.43	0.0223	1.140	0.0268
31.0	26.22	3.03	28.22	0.60	0.326	22.44	1.88	0.0155	1.605	0.0235
46.5	28.56	3.61	32.38	0.75	0.371	23.72	2.12		1.970	
LSD 5%	0.52	0.05	0.04	0.94	0.01	0.62	0.22		0.10	

Table (6):- Effect of K rates on growth characters and yield of cowpea intercropped with cassava 1998- 1999

K20 kg/ fed	Plant height cm.	No. of branch / p.	No. of pods / p.	W. of pods kg/ p	W. of seeds kg/ p	W. of 100 seeds /g	Yield of pods ton/fed	A. E. Rate	Yield of seeds ton/fed	A. E. rate
1998										
24.00	30.59	2.82	18.43	0.29	0.139	21.89	1.04	0.0031	0.486	0.0024
48.00	31.60	2.92	18.94	0.32	0.147	22.72	1.08	0.0063	0.544	0.0025
72.00	32.67	3.12	19.94	0.33	0.153	24.78	1.19		0.605	
LSD 5%	0.53	0.11	0.03	N.S	N. S	1.18	0.11		N. S	
1999										
24.00	25.92	2.86	27.38	0.584	0.276	21.84	1.63	0.006	1.532	0.0015
48.00	26.81	3.06	27.76	0.596	0.329	22.17	1.78	0.0006	1.582	0.0009
72.00	27.31	3.19	28.79	0.604	0.386	22.78	1.92		1.605	
LSD 5%	N. S	0.05	N. S	N. S	N. S	N. S	N. S		N. S	

Table (4): Effect of intercropping on growth characters, yield and yield components of cassava intercropped with cowpea in 1998/1999 – 1999/200 seasons

Systems	Plant height cm	No of total branches /P	No of primary branches /P	No of secondary branches /P	No of total tubers /P	No of mark tubers /P	Av length of mark tubers /p	Diameter of mark tubers /p	D/L Ratio	Av length of unmark tubers /p	Diameter of unmark tubers /p	D/L ratio	Weight of fresh tubers Kg/fed	Yield of fresh tubers Ton /fed
1998/1999														
1:2	184.34	9.32	2.46	6.86	9.69	4.22	38.63	3.59	0.093	24.72	3.33	0.135	3.43	12.05
Control	224.35	11.02	2.86	8.15	9.80	4.53	38.74	3.66	0.094	25.18	3.37	0.134	3.88	13.95
L.S.D at 5%	9.28	5.24	0.15	0.51	N.S	0.29	N.S	N.S		N.S	N.S		0.23	1.29
1999/2000														
1:2	168.85	7.69	1.94	5.22	8.64	3.31	37.06	3.40	0.091	25.46	3.14	0.125	3.04	10.95
Control	205.40	9.73	2.48	7.25	9.41	3.96	37.14	3.61	0.097	26.38	3.27	0.123	3.54	12.64
L.S.D at 5%	8.80	0.45	0.14	0.42	0.22	0.37	N.S	0.09		N.S	0.07		0.15	0.61

2-2-Effect of potassic fertilizer rates on growth characters, yield and yield components of cowpea intercropped with cowpea

Data presented in Table (6) indicated clearly that cowpea height increased consistently with increasing the rate of potassium fertilizer. Similarly, the average number of branches / plant increased with increasing the rate of potassic fertilizer up to highest level. Yield components of cowpea plants, i. e, the average number of pods /plant, weight of pods /plant, weight of seeds /plant and weight of 100 seeds followed the same general trend. It is also evident that there is a positive correlation between yield /fed and addition of potassic fertilizer up to the heaviest rate (72 kg/fed of K_20).

Data on utilization rate indicate also the two contradictory trends. While there were increases in A. E. with increasing the rate of potassic fertilizer in 1998 season, A. E. decreased with K fertilizer increase in 1999 season. The severe deficit of potassium in the sandy soil in the first season, and less requirement of K in the second year was the cause and effect.

2-3-Fertilizer utilization rate

The data in table (7) revealed two opposing kinds of response. While the rate of fertilizer utilization increased in the first season with increasing the rate of potassic fertilizer of both weight of pods / fed. and weight of seeds / feddan, a decrease in the rate

Table (3):- Fertilizer utilization rate of potassic fertilizer

	Phosphatic fertilizer			**Potassic fertilizer**		
Year	Rate of fert.	fresh tubers kg /p	fresh tubers ton /fed	Rate of fert.	fresh tubers kg/ fed	Fresh tubers ton /fed
	15.50			24.00		
1998 **1999**		0.035 0.043	0.112 0.158		0.033 0.027	0.118 0.098
	31.00			48.00		
1998 **1999**		0.026 0.033	0.068 0.120		0.039 0.029	0.157 0.104
	46.50			72.00		

The analysis of data also evidenced that all interactions effects of potassium and phosphorus fertilizer and cropping systems were insignificant although, regular trends were observed. The interaction effect on growth, yield and yield components of cassava plants were in favour increasing phosphorus and potassium fertilizer up to the heaviest rate. On other hand was in favour, growing cassava in pure stand.

2- Effect of phosphatic and potassium fertilizer rates on growth characters, yield and yield components of cowpea intercropped with cassava.

2-1-Effect of phosphatic fertilizer rates on growth characters, yield and yield components of cowpea intercropped with cassava.

Data in table (5) indicated clearly that there were gradual increases in plant height with increasing the phosphatic fertilizer up to the highest rate, i. e, 46.5 kg P_20_5 /fed. Similar trend predominated the average number of pods /plant, weight of pods /plant, weight of seeds /plant and weight of 100 seeds. These traits increased consistently and remarkably with increasing the rate of phosphatic fertilizers up to the heaviest rate , i. e, 46.5 kg P_20_5 / fed. These results were in agreement with Cassman et al (1981). Both yield of pods /fed and yield of seeds /fed followed the same trend. Yield of cowpea pods and seeds increased with increasing the rate of phosphatic fertilizer up to the heaviest. The data on utilization rate indicated two opposing trends in both seasons. While there were increases in A. E. with increasing P fertilizer in 1998 season, the reverse was true in 1999 season. It seemed that there was severe deficiency of phosphorus in this sandy soil in the first season, whereas, cowpea requirement to phosphorus in the second year tended to decrease.

Table (2): Effect of K rates on growth characters, yield and yield components of cassava intercropped with cowpea in 1998/1999 – 1999/200 seasons

K_2O kg/Fed	Plant height cm	No. of total branches /P	No. of primary branches /P	No. of secondary branches /P	No. of total tubers /P	No. of mark tubers /P	Av. length of mark tubers /p	Diameter of mark tubers /p	D/L Ratio	Av. length of unmark tubers /p	Diameter of unmark tubers /p	D/L ratio	Weight of fresh tubers Kg/fed	A.E rate	Yield of fresh tubers Ton/fed	A.E rate
1998/1999																
24.0	193.60	9.74	2.54	7.20	8.87	3.74	38.10	3.55	0.093	25.81	3.15	0.122	2.92	0.037	10.50	0.118
48.0	199.11	10.25	2.65	7.60	9.65	4.33	38.60	3.59	0.093	27.52	3.35	0.122	3.55	0.039	12.37	0.157
72.0	210.31	10.52	2.79	7.72	10.72	5.07	39.30	3.76	0.096	28.06	3.55	0.127	4.48		16.14	
L.S.D at 5%	N.S	N.S	0.19	0.62	1.39	0.35	N.S	0.11		N.S	0.12		0.28		2.80	
1999/2000																
24.0	180.60	8.38	2.13	6.21	8.14	3.04	36.74	3.33	0.091	24.86	2.97	0.119	2.64	0.027	9.51	0.098
48.0	186.40	8.69	2.16	6.54	9.03	3.59	36.94	3.47	0.094	26.34	3.24	0.123	3.29	0.027	11.70	0.104
72.0	194.37	9.06	2.34	6.76	9.90	4.28	37.62	3.72	0.099	26.86	3.41	0.127	3.94		14.19	
L.S.D at 5%	10.79	N.S	0.17	N.S	0.33	0.46	N.S	0.12		N.S	0.09		0.19		0.74	



fertilizer, A. E. increased.

1-3-Fertilizer utilization rate.

Data presented in Table (3) on the rates of utilizing phosphatic and potassic fertilizers indicate that economic production obtained per unit of nutrient applied revealed two opposing kind of response. While the rate of fertilizer utilization increased in both seasons with adding potassic fertilizer up to the heaviest rate, A.E. of the phosphatic fertilizer behaved the reverse. A.E. weight of fresh tubers and yield of fresh tubers decreased with adding the heaviest dose of phosphatic fertilizer. These trends indicate clearly that cassava plant in the sandy soil of El-Ismaillai still requires more potassium rather than phosphorus since harvest of cassava roots removes more k than any other element from the soil (about 102 kg k_20 / ha in 25 t of roots).

1-4-Effect of intercropping on growth characters, yield and yield components of cassava intercropped with cowpea.

Data in Table (4) revealed that cassava height was statistically shorter when intercropped with cowpea, in both seasons. These results were concordant with those obtained by Silva (1982). The total number of branches /plant and the average number of primary and secondary were significantly reduced due to intercropping and were supported by Okolib *et al* (1996). The Average number of total tubers /plant was adversely affected by intercropping. Mason *et al* (1986) supported these results.

Data on yield components of cassava revealed that the average number, length and diameter of marketable and unmarketable tubers were diminished, although insignificant in most cases. Oliviera *et al* (1990) and Sheela *et al* (1996). Came to similar results. The effects on diameter to length ratio of either marketable or unmarketable tuber were not constant and no trend could be detected. Intercropping had a detrimental effect on weight of fresh tubers / plant and the yield of fresh tubers / feddan. These results were supported by Mason *et al* (1986), Olasantan (1988).

increases in the total number of cassava branches (primary and secondary branches) with increasing the rate of phosphorus fertilizer up to the highest in both seasons. These results were supported by Correa *et al* (1981), and Khalil (1995).

Significant effects were also indicated due to increasing phosphatic fertilizer rate on cassava tuber characteristics, i. e, number, average length and diameter of marketable and unmarketable tubers. There were ever increases in these traits with increasing phosphorus fertilizer rate up to the heaviest, indicated that phosphorus has had a paramount effect on tuber length rather than tuber diameter. Ahit *et al* (1981), Muniarti and Siregar (1989) and Gaballah (1991), supported these results.

Weight of fresh tubers of cassava as well as yield of fresh tubers of cassava plant /fed was significantly influenced by rate of phosphorus fertilizer. Consistent and gradual increases of both traits were indicated with increasing phosphorus application up to the highest in both seasons. The excesses in yield of cassava received the highest rate over those received moderate and lower rates were estimated to 7.88, 15.26, 31.31 and 53.38% in both season, respectively.

Concerning the economic production obtained per unit of nutrient applied, data revealed that A.E weight of fresh tubers /plant and yield of tubers /fed. Declined with increasing phosphorus application from 15.5 to 46.5 kg P_20_5 /fed indicating the continuation of phosphatic fertilizer effect but at a slower rate. However, these results are coincided with Edwards *et al* (1977).

1-2-Effect of potassic fertilizer rates on growth characters, yield and yield components of cassava plants.

Data in Table (2) indicated clearly that cassava growth, yield components and yield were also responsive to potassium fertilizer application. Positive responses were associated with increasing the rate of potassium fertilizer rates on both plant height and the total number of branches/ plant in 1999 season. These results were in agreement with those obtained by Nair and Aiyer (1985). Potassic fertilizer rate had also more pronounced effect on cassava yield components, i. e, the average number of total tubers /plant, number of marketable tubers/ plant, average length and diameter of marketable tubers and diameter/ length ratio of the tubers. The values of all these traits tended to increase with increasing the rate of potassic fertilizer up to the highest rate, i. e, 72 kg k_20 / fed. Data on D/ L ratio also indicated that potassic fertilizer had more appreciable effect on tuber diameter rather than tuber length. Yield response to increasing potassium fertilizer rate followed the general tendency of the treatment effect. There were gradual and consistent increase in yield of tuber with increasing potassium fertilizer rate up to the heaviest, i. e, 72 kg k_20 / fed. It is well known that potassium is essential for carbohydrate translocation from the tops to the roots, consequently, an inadequate supply of potassium for cassava will thus lead to excessive top and little root production. Asher *et al* (1980). A.E. data revealed also that cassava plants, were still responsive to potassium application even up to the highest rate. The data also evidenced that with increasing the rate of potassium

1-b) Solid planting of either cassava or cowpea (cultural practices were as recommended for either crop).

2- Phosphorus fertilization rates

Three phosphorus fertilizer levels were used 15.5, 31, and 46.5 kg P_2O_5 /fed. in the form of calcium superphosphate

3- Potassium fertilization rates

Three potassium fertilization rates were used 24, 48 and 72 kg K_2O / fed. Phosphorus fertilizer was applied as one dose at time of planting whereas, potassium fertilizer was splitted into three equal doses added after 4,10 and 15 weeks from planting.

The treatments of each experiment were assigned randomly in three replications in complete randomized block system. The plot area was $10.5m^2$ and included 3 ridges each 3.5m in length and 1m width .Intra row spacing was 100cm (3plants /m) for cassava and 20cm (15plants /m) for cowpea

Cassava stalks were cut into cuttings each of 25-30 cm in length and planted at 26^{th} of March in the first season and at 21^{th} of March in the second. The stalks were planted vertically by inserting two third of the stalks into the soil keeping one third of them above the ground .All treatments were irrigated immediately after planting and irrigated routinely at four days intervals during summer seasons and 7-10 days during winter seasons. Nigerian cowpea was sown on the 14^{th} of May in the first season and on 19^{th} of May in the second on ridges 50 cm. apart and in hill 20cm. apart and grown solid or intercropped. Hills were thinned to one plant after 21 days from sowing. The seed was inoculated with Rhizobium bacteria before sown and immediately irrigated.

Growth, yield and yield components of both crops were determined. Total nitrogen, phosphorus and potassium in the leaves and tubers of cassava and leaves and seeds of cowpea were determined and HCN content in cassava tubers. The competitive relationships, Land equivalent ratio (LER) according to willey (1979), Relative crowding coefficient (RCC), Aggressivity (Agg) according to Mc. Gilichrist (1965), Competition ratio (CR) were also calculated.

RESULTS AND DISCUTIONS

1-Effect of posphatic and potassium fertilizer rates on growth characters, yield and yield components of cassava intercropped with cowpea

1-1-Effect of posphatic fertilizer rates on growth characters, yield and yield components of cassava intercropped with cowpea .

Data in Table (1) indicated clearly that cassava height were remarkably influenced by phosphorus fertilizer rates. There were consistent increases in cassava height with increases in phosphorus fertilizer rate in both seasons up to the heaviest (46.5 kg P_2O_5 /fed.) . These results coincided with Muniarti and Siregar (1989) and Khalil (1995). The data revealed that there were consistent

INTRODUCTION

The recent introduction of cassava in Egypt is very promissing on an experimental level, since it can substitute wheat with the ratios of bread containing 30%of cassava flower. It can also partially substitute maize with ratios of animal feed containing 20-25% of dried cassava tubers. Scantly local research work has been devoted to this crop, consequently various trials for appropriate cropping system under Egyptian environmental conditions must be undertaken. Major consideration in fertilizer recommendations for cassava is that cassava was a high requirement phosphorus and potassium.

In this respect, Ahit et al (1981), and Corea et al (1981) found that with increasing phosphorus level to cassava plants, root diameter length and root weight and yield increased. Nair and Ayer (1985), Muniarti and Siregar (1989), Gaballah (1991) and Khalil (1995) demonstrated that tuber length, length of marketable tuber, tuber diameter, number of total marketable tubers /plant increased significantly with increasing phosphorus fertilizer rate. Increasing phosphorus or potassium fertilizer rate significantly increased number of primary as well as secondary branches /plant, yield per plant and yield of tubers /fed. Edwards et al (1977) and Asher et al (1980) reported also that agronomic efficiency A. E. of phosphorus and potassium application had positive effects on weight of fresh tubers /plant and yield of tuber /fed with increasing the rate of any of these fertilizers. Payne and Webster (1956) found that higher HCN content of cassava tubers was observed in K deficient soil than K sufficient soil. Silva (1982), Mason et al (1986), Olasantan (1988), Olivera et al (1990), Okolib et al (1996) and Sheela et al (1996) in their studies on intercropping cassava with cowpea reported that cassava yield was decreased significantly by intercropping. Reduction was due to decreased in number of tubers /plant. On other hand, Cassman et al (1981), Katunzi et al (1987) and Okolib et al (1996) found that intercropping with cassava led to reduction in yield of cowpea seeds and mean number of pods /plant.

However the objectives of this study are to evaluate the effect of intercropping cowpea with cassava to optimize phosphorus and potassium rate and to study their effect on growth, yield and yield components of both cassava and cowpea plants in the association.

MATERIALS AND METHODS

Two field trials were conducted in Ismaellia Reasearch station during the seasons 1998 /1999 and 1999 /2000. to study the effect of some rates of phosphorus and potassium on growth, yield and yield components and chemical content of cassava grown in association with cowpea and checked with cassava grown solid. The treatments were the combinations of cropping system, 3 rates of phosphorus and potassium fertilizers. As follows:

1-Cropping system:

1-a) cassava cv. Brazelia intercropped with cowpea cv. Nigerian (331) in alternative system cassava: cowpea (1:2).

INTERCROPPING CASSAVA WITH NIGERIAN COWPEA UNDER DIFFERENT FERTILIZER RATES IN SANDY SOIL

Adel S. El- Hassanin[1] Nagib M. Nassar[2]
Ahmed Said Mostafa Kamel[3] Sahar Ali Sherief[4]

ABSTRACT

Two experiments were conducted in Ismaillia Research Station during seasons 1998/ 1999 and 1999/ 2000 to study the effect of three phosphorus fertilizer rates, i. e, 15.5, 31.0, 46.5 kg P_2O_5 / fed, three potassium fertilizer rates, i. e, 24.0, 48.0 and 72.0 kg k_2O/ fed. and two cropping systems, i. e, intercropping cassava with cowpea plants in the ratio of 1 ridge cassava : 2 ridges cowpea and sole cropping of both crops.

Data obtained revealed that plant height, average number of primary, and secondary branches /plant, total number of marketable tubers, length , diameter of marketable tubers, yield per plant and per feddan increased with increasing phosphorus and potassium fertilizer up to the heaviest rates (46.5 kg P_2O_5 ; 72 kg K_2O /fed). Cassava growth, yield and yield components decreased with intercropping. Growth, yield and yield components of cowpea in the association followed the same trend as affected by fertilizer rates or intercropping. Data on fertilizer utilization rate (A. E.) evidenced that the value of A. E. for cassava increased with increasing either phosphorus or potassium fertilizer rates in the first season, but, decreased in the second season. The rate of utilizing phosphorus fertilizer exceeded that of potassium fertilizer. Cowpea was always responsive to both fertilizers up to the heaviest rates.

Intercropping cassava with cowpea achieved yield advantage with LER estimated to 71 and 58% in both seasons. Aggressivity data indicated that cassava was always the dominant component. Increasing phosphorus and potassium fertilizer rates tended to increase nitrogen and protein concentrations in cassava and cowpea leaves, tubers and seeds whereas, intercropping inversely behaved. Data on HCN revealed also that the more the applied potassic fertilizer was, less HCN content was found in tuber tissues. HCN in tuber of intercropped cassava was always higher than in pure stand cassava.

[1]Prof. of soil Science and Vice- Dean Institute of African Research and Studies Cairo University.
[2] Non Emertus Prof. of plant Resources Dept. of Natural Resources Institute of African Research and Studies Cairo Univeristy.
[3]Prof. of Crop Intensification Agriculture Research Center- Field Crop Research Institute .
[4] Researcher in Agriculture Research Center - Field Crop Research Institute- Crop Intensification Research Section.

استخلاص ودراسة خواص لجنين سرس الأرز

أ٠د ا عاصم محمود حسين ، د ا محمد هشام ياسين

كلية علوم بنها - جامعة الزقازيق

استخلص اللجنين من سرس الأرز بالتسخين فى الأتوكلاف عند درجة حرارة ١٣٥°م فـــى محلـــول صودا كاوية تركيز ١٧ % بنسبة ٧ : ١ وزن / حجم ٠ تم فصل السيليكا بمعاملة الســائل الأســود بإضافـــة ٤,٥ % كلوريد الصوديوم ثم ١٠ % حامض ايدروكلوريك حتى درجـــة أس ايدروجينـــى ٩ ، ثـــم فصلـــت السيليكا ثم اضيف مزيد من حامض الأيدروكلوريك ٥ % حتى الوصول إلى درجـــة الأس الأيدروجينـــى ٤ وعندها رسب اللجنين على شكل قشور بنية اللون فصلت بالطرد المركزى وتم تنقية هـــذا اللجنيـــن بالغســـل بالماء لعدة مرات ٠

درست خواصه الفيزيائية الآتية :

أ - طريقة الامتصاص فى الأشعة فوق البنفسجية : تبين أن لهذا اللجنين قمة امتصاص عند ٢٨٢ ن م ٠

ب - طيف الامتصاص فى الأشعة تحت الحمراء : تبين وجود قمم امتصاص تدل على وجود المجموعـــات الوظيفية الآتية :

(OH , aliphatic CH, C ≡ C , C = C , $^{H}\!\!>\!C = O$, $C\!-\!\overset{O}{}\!-\!C$, aromatic CH)

جـ - تبين أن اللجنين يحتوى على نسبة ٥٦,٦٥ % من الكربون ونسبة ٥,٥ % من الـــهيدروجين ونســـبة ٣٧,٨٥ % من الاوكسجين ٠

د - كما درست خواصه فى الطيف الكتلى وتبين أن الوزن الجزيئى للجنين يســـاوى ٧٠٠ ٠ وتحليـــل العناصر اعطى الشكل الجزيئى التالى للجنين (ك٣٠ هـ٤٠ أ١٠)

Wong , K.K.Y.; K.F.Deverell; L.M. Keith; T.A. Clark and L.A. Donaldson (1988):The relationship between fiber porosity and cellulose digestibility in steam exploded pinus radiata . Biotechnol. Bioeng. , 31: 447 - 456.
Yasin , E.S. (1993) : Nonconventional uses of rice hulls, Ph. D.Thesis: Botany Department, Faculty of Science, Zagazig Univ. Benha Branch.

REFERENCES

Bungay, HR. (1985): Progressand perspectives of new biomass industries. pages 319 — 326 in: Biotechnology in international Agricultural Research. mt. Rice Res. Inst . Los Banos, Laguna , Philippines.

Ghose, T.K. (1981) : Cellulose conversion pages 225 - 266 in : Advances in food producing systems for Arid and Semiarid lands . Port A. T.T. Manassah and E.J. Briskey, eds. Academic press. New York.

Grohmann, K;R. Torget and M.Himmel (1985): Optimization of dilute acid pretreatment of biomass. Biotechnol . Bioeng. Symp., 15 : 59 - 80

Hussein, A.M.; H.El-Said and E.S. Yasin (1992) : Bioconversion of hemicelluloses of rice hulls black liquor into single cell protein, J. Chem. Tech. Biotechnol, 53, 147 - 152.

Hutanuwater, N.; F.C. Hinds and C.L. Davis (1974): An evaluation of methods for improving the in vitro digestibility of rice hulls. J. Anim. Sci. 28: 140 - 148

Ibrahim, M.N.M. (1983) : Physical, chemical, physico - chemical and biological treatments of crop residues pages 53 - 68 in : The utilization of fibrous agricultural residues . Aust. Deu. Assistance Bur. Res . Deu. Seminar 3, Los Banas, Loguna, Philippines, 1981. G.R. Peorce, ed. oust. Gont, Publ. Serv., Canberra.

Jackson, M.G. (1977) : Review article : The alkali treatment of straws. Anim. Feed Sal. Technol . 2: 105 - 130.

Leonzio, M. (1966) : The contents of lignin as a by - product during the elaborationof rice Riso 15, 219 - 223 (Italian).

Mizuki, E.; S. Okumura ; H. Saito and S. Murao (1993): Formation of silicon carbide from rice husks using enzymatic method for carbon control, Bioresource Technol. 44(1) : 47 — 51.

Morjanoff, P.J. and P.P. Gray (1987): Optimization of steam explosion as a method for increasing susceptibility of sugar cane bagasse to enzymatic sacchrification. Biotechnol. Bioeng., 29: 733 — 741

Neish, AC. (1965): Coumarins, Phenyipropanes and lignin . In plant biochemistry . J. Bonner and T.E.Vorner (Editors). Academic press, New York.

Nelson , G.H.; L.E. Talley and S.!. Aranovesky (1950) : Chemical composition of grain and seed hulls, nut shells, and fruit pits. Trans. Am . Assoc. Cereal chem. 8: 58 — 68.

Rodriguer — Varquer , R.; M.Areyzaga ; A. Parada; E. Rias — leal and C. Anguis — Terrazas (1993) : Isolation and characterization of lignin from rice hulls. Journal of the science of food agricultural. 1993 , 62 (1): 101 - 104

Sharma, S.D. (1974): A study of roughage silica solubility, M.S.thesis, G.B.Pant Univ. Pantnagar, India, 77 pp (cited in Jackson, 1977b).

Toussaint, B. , 0. Excoffier and M.R. Vignon (1991): Effect of steam explosion treatment on he physico — chemical characteristics and Enzymatic hydrolysis of poplor cell wall components. Anim . Feed sci. Technol, 32 : 235 — 242.

Van Soest, P.J. (1969) : The chemical basis for the nutritive evaluation of forages, proc. Nat!. Conf . Forage Quality Evaluation and utilization, Lincin, NE, 19 pp.

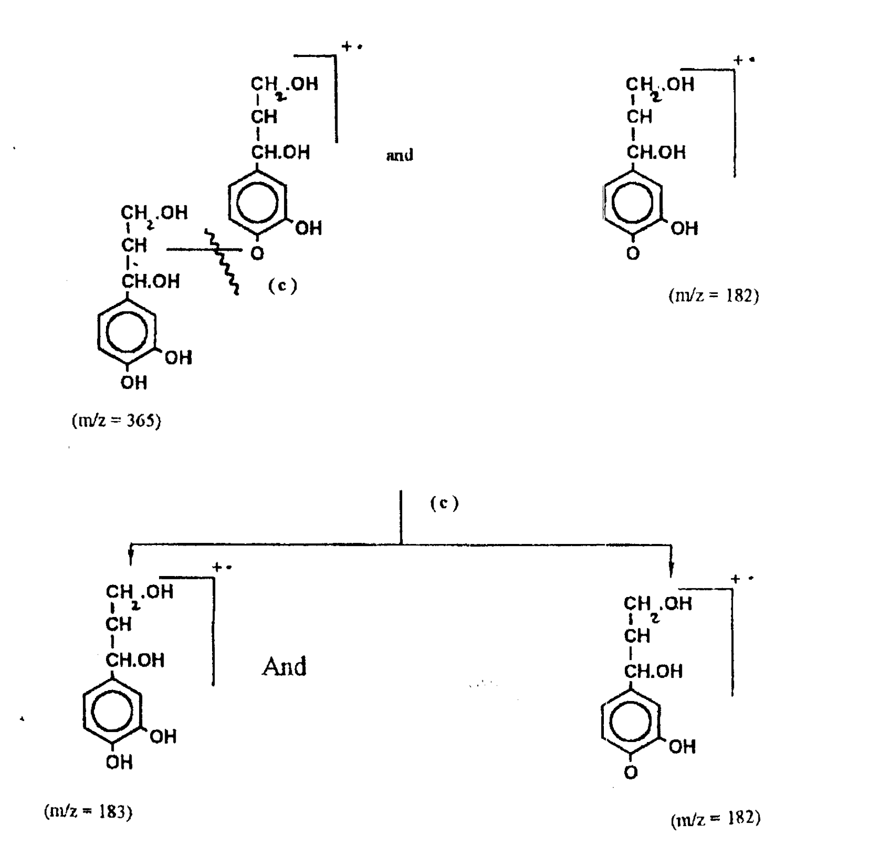
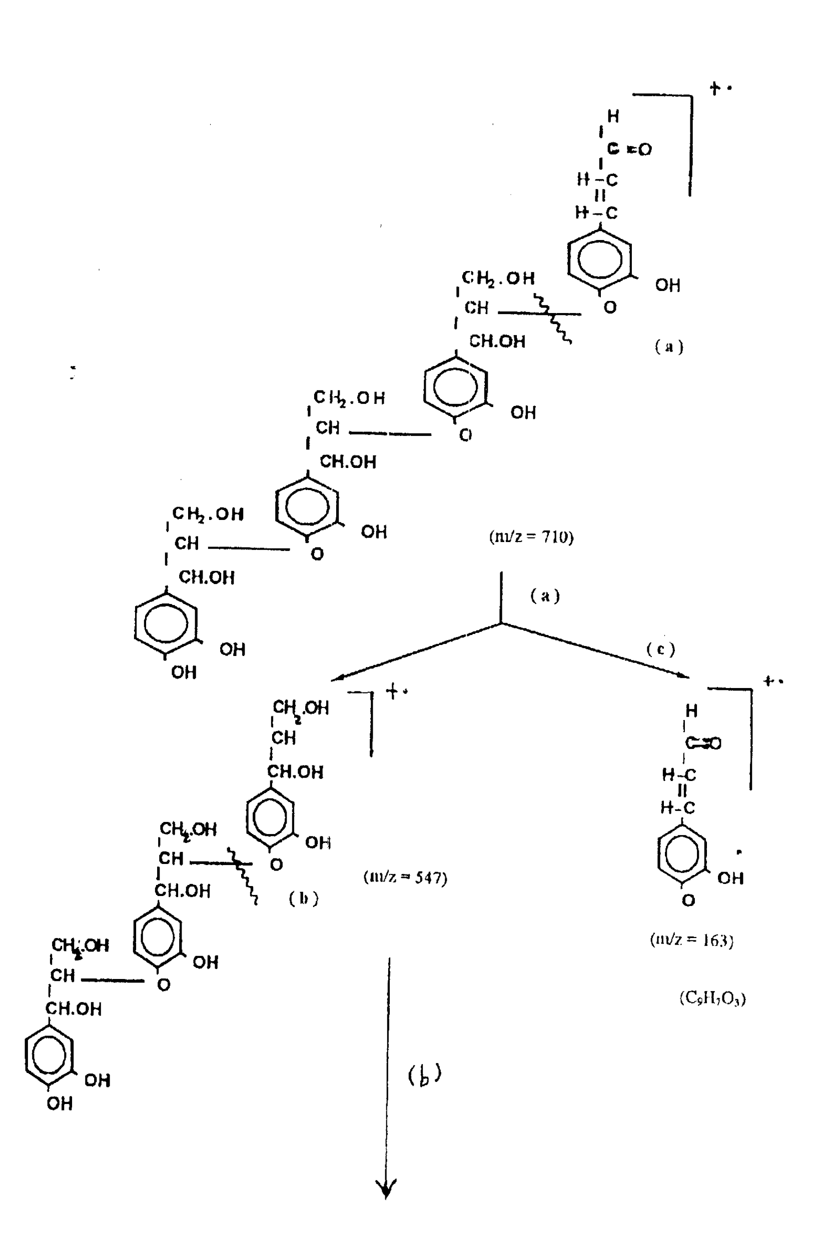


Fig. (4): The fragmentation pattern of the lignin.


(a)
(m/z = 710)
(a)
(c)
(m/z = 547)
(b)
(m/z = 163)
($C_9H_7O_3$)
(b)

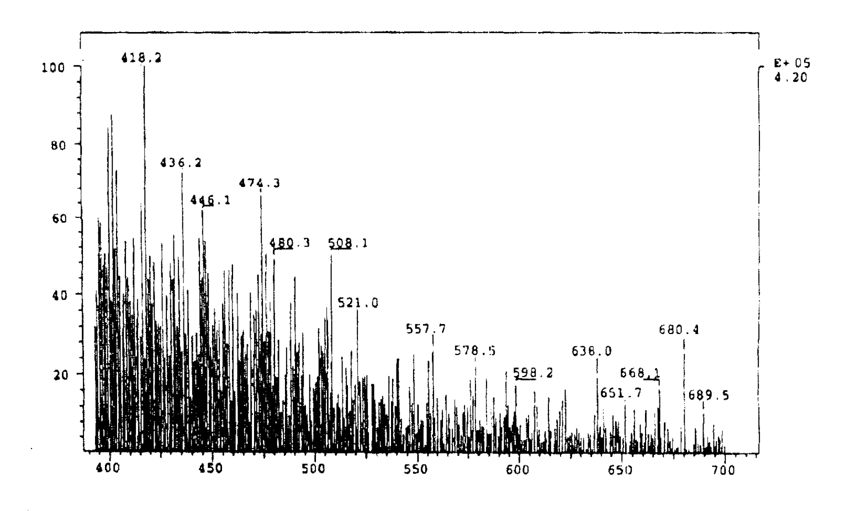


Fig (3) Mass Spectrum of purified lignin

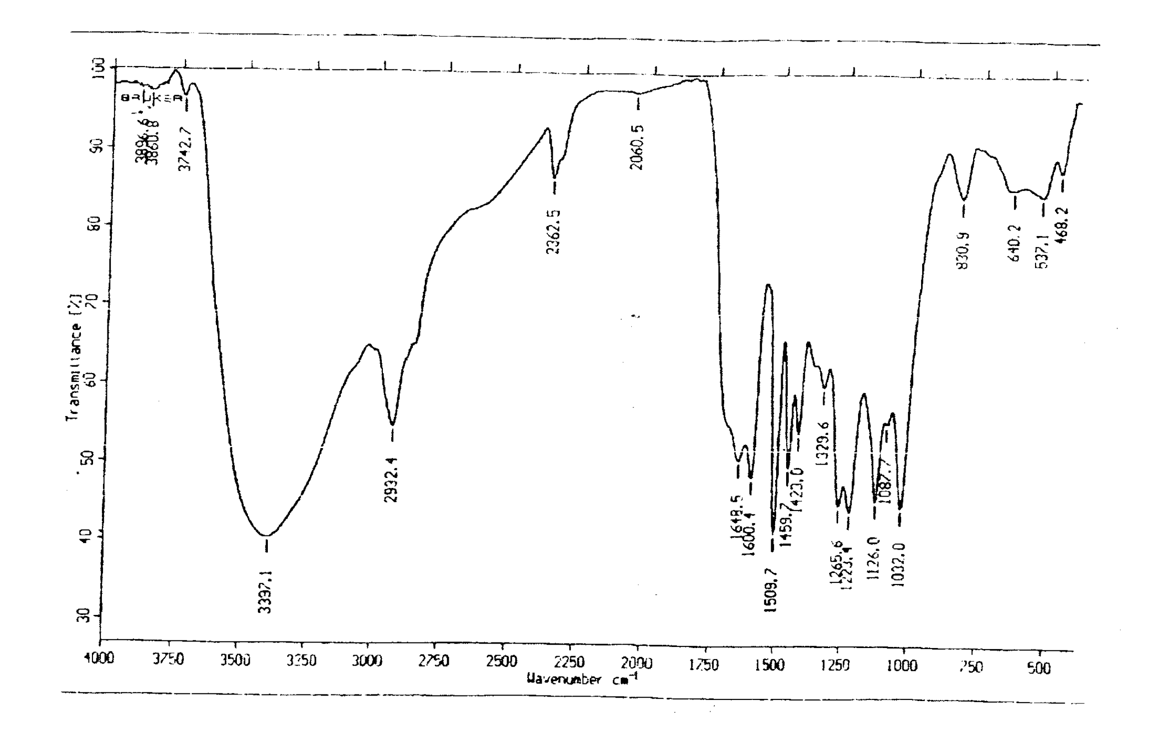


Fig (2) IR Spectroscopy of purified lignin

Recently lignin has been the object of a renewed interest because of the need to use raw materials from renewable resources. Lignin is one of the most abundant naturally occurring polymers, usually obtained as a by - product generated throughout all pulping processes and burned on site to generate heat due to its high energetic content. One of the main drawbacks of lignin, from a practical standpoint, is the variability observed in its composition, molecular structure, and molecular weight. These three factors depend on the type of plant from which it is obtained and have motivated a large number of investigations devoted to the study of lignin structure.

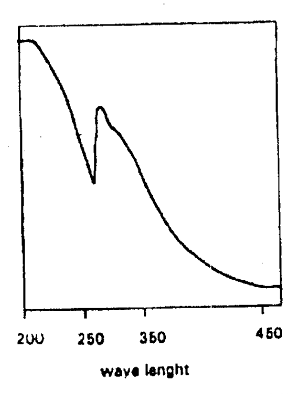


Fig (1) UV spectrum of purified lignin

Elemental analysis :

Elemental analysis showed that carbon percent was *56.65 %*, hydrogen percent *5.5 %*, and by difference oxygen percent was *37.85 %*.

Proposed structure: Proposed structure for lignin $C_{35} H_{40} O_{15}$ The structure supported by the following:

(1) Elemental analysis : Which gave molecular formula equal to $C_{35} H_{40} O_{15}$ and its molecular weight equal to 700.

(2) I.R.(c.f. Table 4).

Table (4): peaks and corresponding functional groups of IR spectrum of purified lignin.

Function group	Frequency ν cm^{-1}
OH	3397
aromatic CH	3050
aliphatic CH	2932.4
C ≡ C	2362.5
H>C = O	1648.5
C = C	1600
C–O–C	1459

(3) Mass spectra: Which showed molecular ion peak at M / Z = 699 (CF fig. 3), the fragmentation pattern of the proposed compound (CF fig. 4) and Table5.

Table 5 : M / Z of lignin followed by the abundance %.

M/Z	abundance %
710	undetectable
699.7	0.70
547	0.42
365	*2.57*
183	17.73
182	11.13
163	15.84

Other than silica rice hull black liquor contains lignin. After silica precipitation lignin remains in solution and it was successfully removed by precipitation on addition of further amounts of HCl to pH 4.0, where lignin precipitated as brown flakes. The purity of such lignin flakes was confirmed by UV and IR spectra.

Table (2): Efficiency of mono - di - and trivalent salts in delignification of black liquor:

Salt	ppt shape and color	PH	Efficiency(%)
NaCl	no	*9-9.5*	0.00
KCl	no	9-9.5	0.00
$CaCl_2$	orown coarse particles	11.3	*19.5*
$BaCl_2$	pale brown coarse particles	11.9	*56.03*
$AlCl_3$	deep brown coarse particles	*5.6*	20.0
$FeCl_3$	plae brown fine particles	*9.5*	31.4

Lignin purification:

100 g of crude lignin (obtained by delignification of black liquor using NaCI and HCI) were autoclaved for ih at *135°C* in *0.5* L of 17 % NaOH. To lignin solution *(5%)* HCl was added gradually till pH dropped to 9.0 then left overnight for precipitation of possible silica content, which was removed by centrifugation. Further amounts of HCl was added till pH 6.0. the solution was left overnight for further silica settling and silica was separated by centrifugation. More HCl was added till pH dropped to 4.0 the solution was left overnight. Lignin precipitated as brown flakes and was obtained by centrifugation. For further purification this process was repeated.

Inorganic impurities of the obtained lignin:

It was necessary to check the purity of the obtained lignin sample. The contained impurities of some metals were estimated (table 3) using polarized atomic absorption spectroscopy.

The data given in table (3) showed that the purified lignin contained nonsignificant amounts of Ni (0.044 mg /g) , Cu (0.015 mg/g) , Zn (0.198 mg/g) ana Fe (0.069 mg/g). This indicates the considerable purity of the purified lignin obtained from rice hull black liquor.

Table (3): Inorganic impurities of purified lignin sample :

element	Sample content (mg / g)
Ca	0.00
Ni	0.044
Cu	0.015
Zn	0.198
Fe	0.069
Mg	0.000

Some physicochemical characteristics of lignin of black liquor:

U.V Spectrum:

Purified samples of ligrnn was dissolved in butanol for spectrophotometric study. Purified lignin showed a single peak of aborption maxima at 282 nm (fig. 1).

IR Spectrum:

The IR spectrum of purified lignin, (fig 2) showed characteristic peaks given in table (4) as well as their possible functional groups.

RESULTS AND DISCUSSION

Lignin from Rice hulls:

During the process of NaOH desilication of rice hulls lignin is extracted into the black liquor where it is contained as soluble sodium ligninate.

Fractional extraction of lignin from black liquor using methanol:
Samples of black liquor (50 ml) obtained by the usual method of NaOH (17%) treatment at *135°C* for one hour, were evaporated till dryness (at 105°C) and total solids were estimated. Lignin was extracted from the obtained solids by small portions of methanol till complete decolorization of solids. lignin content was estimated as the difference in dry weight of solids before anci after extraction of lignin (table 1)

Table (1): Extraction of lignin from black liquor using methanol:

B.L Volume (ml)	T.S (g)	Lignin (g)
50	4.48	2.276
50	4.366	2.308
50	4.294	2.288
Average	**4.380**	**2.291**

Dezincification of desilicated black liquor using mono-di-and trivalent salts :

Lignin is a colloidal substance that can be coagulated on the addition of electrolytes at specific pH. The previous experiments on the desilication of rice hulls black liqour showed that the use of monovalent electrolytes led to the coagulation of silica particles only but not lignin. The present trial deals with the delignification of lignin via coagulation using di - or trivalent electrolytes.

To patches (0.5 L) of desilicated black liquor (using 5 % NaCl and 10 % HC1) solutions of either one of divalent ($CaC1_2$, $BaCl_2$) or trivalent ($AlCl_3$, $FeC1_3$) electrolytes were pipetted till no further precipitation took place. The precipitate was separated by filtration, dried and weighed.

The data given in table (2) show that using either di or trivalent electrolytes did not lead to the coagulation of all lignin in the black liquor. However they differ in their efficiency of coagulation of lignin. $BaC1_2$ was of moderate coagulating capacity (56.03 %) , followed by $FeCl_3$ (31.4 %). $CaC1_2$ and Aid3 were of equal low (about 20%) lignin coagulating capacity. There was no relation between the valencey of the used cations and their coagulating capacity of lignin.

This could be attributed to the formation of insoluble hydroxides of these cation on the addition of the tested chloride salts to the, rich in sodium hydroxide, black liquor.

chemical treatments are known to disrupt lignocellulosic cell wall materials (Grohmann et al , 1985; Morjanoff and Grey, 1987 ; Wong et al, 1988; Toussaint et al, 1991), while alkali treatment, particularly with NaOH, disrupts the cell wall by dissolving hemicelluloses, lignin and silica; as well as hydrolyzing uronic and acetic acid esters ; together with swelling cellulose. This was found to improve the digestibility of cereal straws (Jackson, 1977 ; Ibrahim, 1983). Hutanuwater et al (1974) and Sharma, (1974) Showed that analysis of rice straw and hulls soaked in NaOH led to a constant decrease in all components of rice hulls except cellulose and lignin. This paper aims at extraction of lignin from rice hulls, purification and characterization.

MATERIALS AND METHODS

Preparation of black liquor from Rice hulls :

One Kg of Rice hulls was mixed with 7L of water and 175g of solid sodium hydroxide in well plugged 20L capacity flask. The flask was autoclaved for one hour at 1.5 atmosphere. The black liquor was obtained by filtration through cotton gauze.

Studies on lignin

Raw material:
Rice hulls were purchased from El-Sharkia rice mill, Zagazig.

Delignification of desilicated black liqur:
The method adopted by Hussein et al (1992) was followed:
To one liter of desilicated black liquor 5 % HC1 was added till pH of the black liquor dropped to 4, left overnight, lignin precipitated as brown flakes which can be easily obtained by filtration.

UV Spectrophotometry:
Perkin — Elmer lambada 3 BUV/VIS spectrophotometer was used.

IR Spectrophotometry:
IR Spectra in KBr disc were recorded on a Shimadzu. Jh-470 spectrophotometer.

Elemental analysis :
Carbon , hydrogen and nitrogen were determined at microanalytical center, Cairo university.

Mass Spectrum : Mass spectrum was determined at National Research Center, Cairo.

Atomic absorption : Procedure : 0.1 g of purified lignin sample was dissolved in 5 ml of 5 % NaOH. Z- 6100 polarized Zeeman atomic absorption spectrophotometer was used for the determination of some mineral content.

EXTRACTION AND CHARACTERIZATION OF LIGNIN OF RICE HULLS

Assem M.Hussein and Mohamed H.Yasin
Benha Faculty of Science, Zagazig University

ABSTRACT

Lignin of rice hulls was extracted by autoclaving at 135 °C in 1:7 W/V 17% NaOH for one hour. Silica was precipitated by the addition of 4.5 % NaC1 and 10 % HC1 till pH 9. Silica was separated by centrifugation and thus desilicated black liquor was obtained. Further amounts of 5 % HC1 were added till pH 4, at which lignin precipitated as brown flakes which was separated by centrifugation and purified by washing. It was found in UV that lignin showed maximum absorption at 282 nm, while IR spectra showed peaks that indicated the presence of following groups: OH, aliphatic CH, C ≡ C, C = C, $^{H}\!\!>$C = O, C–O–C, , aromatic CH. lignin contained 56.65 % C, 5.5 % hydrogen and 37.85 % Oxygen. Lignin physical characteristics were studied by mass spectra. Molecular weight of lignin was equal to 700, the elemental analysis gave molecular formula equal to $C_{35} H_{40} O_{15}$.

INTRODUCTION

Lignin content in rice hulls ranges from 19.2 to 24.47% (Leonzio, 1966). Neish (1965) reported that large part of the lignin is chemically combined with the hemicelluloses, and that the middle lamella of the cell walls may contain 70 % of the lignin associated with pentoses and cellulose.

Lignin is a phenyl propanoid structural polymer of vascular plants that gives the plant's rigidity and binds the cells together (Nelson et al, 1950 ; van soest, 1969). Solvent refining of lignocellulosic residues involves lignin extraction with a mixture of either dilute acids or alkali mixed with either butanol, ethanol, phenol or formic acid (Bungay, 1985).

Rodriguer - Varquer et al, (1993) isolated lignin from rice hulls by dioxane acidolysis with different concentrations of HC1 in the solvent medium. Maximum lignin yield was obtained with extraction for 2h. with 5.66g concentrated HC1/L. Delignification of rice hulls and straw with a two - stage alkali treatment and with solvent treatment improved the accessibility of the substrate to cellulose hydrolysis (Ghose, 1981) . Mizuki et al, (1993) noted that, upon treatment with alkali, the amount of lignin in rice hulls. was progressively decreased.

For delignification of desilicated black liquor produced from 17 % alkali -treatment of rice hulls, the addition of equivalent amount of either HC1, HNO_3 or $H_2 SO_4$ led to the precipitation of lignin in the form of brown floccules at high pH value (9.9) (Yasin, 1993). Lignin of two important Brazilians agricultural wastes were purified and characterized by ultraviolet spectrophotometry. Steam and pressure treatments alone or allied with

الملخص العربى

اثر استخدام الطاقة الشمسية لتعقيم التربة على اعداد حيوانات التربة فى منطقة دمو بمحافظة الفيوم

مارجريت عدلى رزق

معهد بحوث وقاية النباتات – محطة البحوث الاقليمية بالفيوم

يعتبر استخدام الطاقة الشمسية لتعقيم التربة وخفض تعداد الآفات الضارة وخاصة النيماتودا وبعض الأمراض والفطريات مثل عفن الجذور والتخلص من الحشائش من الوسائل الهامة والنظيفة للبيئة وخاصة فى محافظة الفيوم حيث انها واحة مغلقة فيجب الأهتمام بعدم تلوث البيئة بها باستخدام المبيدات واستخدام وسائل بديلة سهلة يمكن تطبيقها بواسطة الفلاح دون صعوبات فنية التطبيق ولذلك يمكن استعمال هذه الطريقة الطبيعية للقضاء على هذه الآفات.

ولكن من المؤكد ان هذه الطريقة قد يكون لها أثر على اعداد حيوانات التربة الأخرى التى تعتبر جزءاً لايتجزأ من هذا المجتمع تحت هذه الأغطية البلاستك ومن المؤكد ان ارتفاع الحرارة مع وجود الرطوبة الزائدة يؤدى الى التأثير المباشر فى خفض بعض الانواع او زيادة تواجد انواع اخرى.

ولقد كانت هذه الدراسة لمعرفة اثر استخدام هذه الطريقة الآمنة فى مقاومة بعض الآفات ليتوخى الحذر من استخدامها ولقد اوضحت الدراسة ان حرث الارض وريها وتغطيتها بالبلاستيك مدة لاتقل عن ٤٥ يوم فى شهرى يوليو وأغسطس التى تعتبر من أكثر شهور السنة فى مصر من حيث ارتفاع الحرارة أدت الى ان اعداد العنكبوت الحقيقى انخفضت من ٢,٥ الى [illegible] والكلوسبولا زادت مع التغطية من ٠,٥ الى ١,٢ وانخفاض اعداد النمل من ١,٥ الى [illegible] وانخفاض اعداد مستقيمة الاجنحة من ١,٣ الى الصفر.

ويعنى هذا ضرورة اعادة تلقيح التربة بالأنواع المفيدة من حيوانات التربة حتى يكون تشميس التربة يعد الطريقة اجراء ذا قيمة للزراعة.

Cotton Conference, San Antonio, T X, U S A, January 4-7, 1995: 1368-1371.

Smith, B. D. (1988) Changing straw dis posal practices. In: R. D. prew (Ed.) Research Review Home Grown Cereals Authority No. 11, UK;61 pp.

Southwood, T. R.E and Henderson, P. A. (2000). Ecological Methods. Blackwell Science Ltd., Oxford: 574 pp.

Tekin, Y.; Kad~oolu, Y. and Uremip, Y. (1999). Studies on solarization against root-not nematode and weeds in vegetable greenhouses in the Mediterranean region of Turkey. Paper distribited at: Biological control and mass raring and releasing techniques of uscliii insects. Training course for mass raring in integrated pest management programs, Adana, Turkey 16:25 August (1999):604-616.

Wallwork, J. A. (1976). The Distribution end Diversity of siol FaunaLondon, 355pp.

Warren, S. D.; Scifres, C. J. and Tee!, P. D. (1987). Response of grassland arthropods to burning: a review. Agriculture Ecosystems and Enviroment, 19, 105-130.

Vats, L. K. and narule, A. (1993) Soil arthropods of Cropland and forest Stand. Annals of Entomology 8 (2}. 39- 42.

Greenslade, P. J. M. and Greenslade, P. (1983). Ecology of soil invertebrates. In : Soils: An Australian Viewpoint, Division of Soils, CSIRO: 645-669.

Hussein, A. M.; Mikhail, W. Z. A. and Eid, T. M. (1998). Populations of functional groups of soil mesofauna in non-tuber vegetable crops in Menouflya. Annals of Agric. Sc. Moshtohor, 37 (2): 2035-2048.

Kromp, B. (1990). Carabid beetles (Coleoptera, Carabidae) as biomdicators in biological and conventional ferming in Austrian potato fields. Biol. Fert. Soils, 9: 182-187.

Lee, H. C. (1995). Sustainable farming practices in Centrol Queensland, Austrolia. in: C. Carroll; M. Halpin and H. F. Cook (eds.) Soil management in sustainable agriculture. Proceedings ThirdInternational Conference on Sustainable Agriculture, Wye College, University of London, 31 August to 4 September 1993:31-36.

Maia, A. I. Serralheiro, F.; Franco, J. and Mareira, 1. (1991). Influence on soil mesofauna of the systems of soil management in vineyards. Proceedings of the 1991 meeting of the Spanish Weed Science Society: 223-226.

Mikhail, W. Z. A. (1993). Effect of soil structure on soil fauna in a desert Wadi in Southern Egypt. Journal of Arid Environments, 24: 321-331.

Mikhail, W. Z. A. and Hussein, A. M. (1997). Activity of soil mesofauna associated with potato fields in Menoflya Governorate, Egypt. Egypt. J. Zool., 28: 139-147.

Mikhail, W. Z. A.; Hussein, A. M. and Eld, T. M. (1998). Relationship of irrigation water and herbivare communities associated with vegetable crops in the Nile Delta. Paper presented at: The International Conference on Water Problems in Africa, 26-2 7 October 1998, Cairo Univ., Cairo, Egypt: 12 pp. (typescript).

Pala, H. and Cinar, A. (1999). Effects of solarization against strawberry root-rot disease in the east Mediterranean region of Turkey. Paper distribited at: Biological control and mass raring and releasing techniques of useful insects. Training course for mass raring in integrated pest management programs, Adana, Turkey 16:25 August (1999): 6 pp.

Rizk, M. A. Ghabbour, S. I. and Mikhail, W. Z. (2000). Effect of irrigation regimes in mixed tomato cultivation on activity densities of the Colembolal Friesea claviseta in Fayoum Region, Egypt. Paper presented at : X International Colloquium on A pterygota, Ceske Budeiovice 2 1-24 Augast 2000 Czechrepublic:13 pp. (typescript).

Rizk, M. A. and Mikhail, W. Z. (1999). Impact of notiilage agriculture on soil fauna diversity. Zoology in the Middle East 18, 1999: 113-120.

Roberts, P. M. and All, J. N. (1993). Hazard for fall armyworm (Lepidoptera: Noctuidae) infestation of maize in double-cropping systems using sustainable agricultural practices. Florida Entomologist 76(2): 276-283.

Rybalov, L. B. (1990). Comparative characteristics of soil macrofauna of some tropical savannah communities in Equatorial Africa:preliminary results. Tropical Zoology 3 (1): 1-11.

Samways, M. J. (1995). Insect Conservation Biology. Chapman & Hall, press; 358 pp.

Slingsbg, D. and Cook, C. (1986). Practical Ecology. Macmillan, London: 213 pp.

Smart, J. R.; Bradford, J. M . and Wolfenborger, D. A. (1995) Cotton response to reduced tillage in the lower Rio (Irande Valley. Proceedings Beitwide

Some agricultural practices have beneficial effect on the soil community, allowing new species to be come established and also promoting general increase in population densities (Waliwork 1976). Soil solarization was decreased the total number of soil fauna, becouse soil solarization increased the soil temperatures, and these traditional decreased the diversity of the soil fauna, particularly the spescies constrain heating condition.

Ryhalov (1990) found that. in the dry season there is gradual decrease of biological activities with some groups passing it in aresting stage and others migrating to more humid habitats. In this study temperature difference between covered (solarized) and uncovered (fallow) or (cultivated) areas the more varied in the top. In this top, all activity of soil fauna occur. Dennis (1993) indicated that the bulk of the soil insect population lie in the top 20 cm of the soil (most are in the top 10 cm). Deep ploughing will bring these rnsects to the surface to be exposed to hot sunlight (insolation), desiccation and predators.

The range of environmental temperature in which this constancy is maintained is characteristic for species and for the stage in development of each individuals (Batt, 1980). Vats and Narula (1993) found that population density of Acarina was positively correlated with temperature. In this study, indicted that, spiders number decreased from 30 individual in fallow plots to 27 individual in cultivated plots, to 4 individuals in solarization plots. Also Warren el a!., (1987) Noted that, increased insolation, allow some grasshopper nymphs to emerge earlier than usual. In this study, indicated that jassid, in solanzation plots was mor than in fallow plots. While, we found snail in solarization plots and population, and one species to anather (Samway, 1995).

In this study, show that solarization can effect not only on the pest insects put also on the all soil faun caused damage in the total number of fauna.

REFERENCES

Austin, K. H. and Gazaway, W. S. (19%). Soil solarization for the control of Nematodes and Soil-Borne diseases. (internet paper).

Bigler, F.; Waldburger, M. and Frei, G. (1995 a). Some diseases and pests of maize. Agrarfarschung 2 *(9)*: 380-382.

Bigler, F.; Waldburger, M. ~and Frei, G. *(1995* b). Important insects and spiders as natural enemies in maize. Agrarfarschung 2 *(9)*: 383-386.

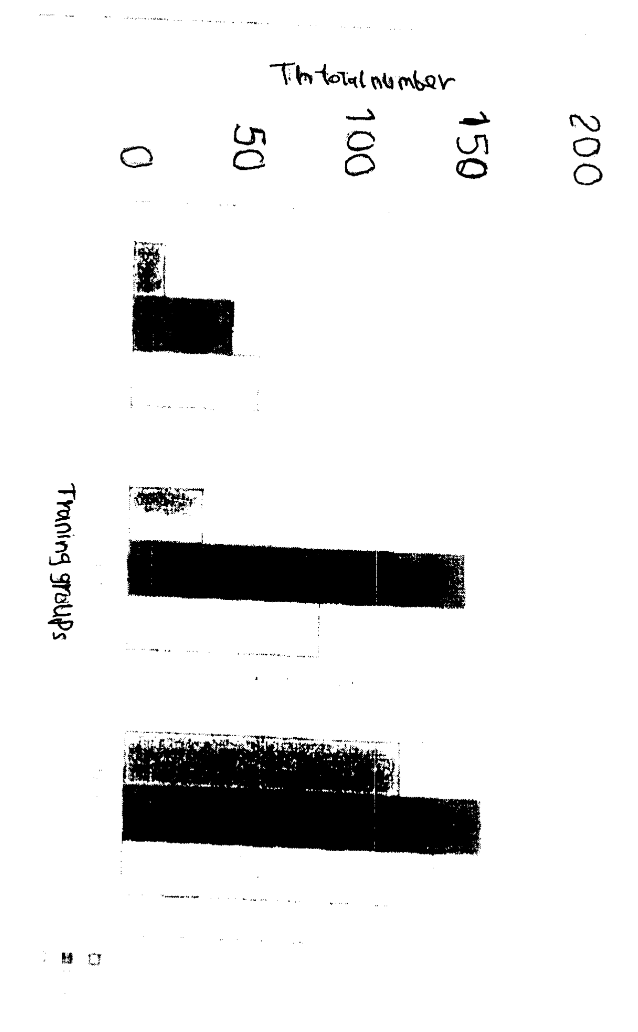
Buntin, G. D.; All, i. N.; Mccracken, D. V. and Hargrove. W. L. (1994). Cover crop and nitrogen fertility effects on southern corn rootworn (Coleoptera:Chrysomeiidae) damage in corn. Journal of Economic Entomology 87 (6): 1683-1688.

Dennis, S. Hill (1993). Agricultural insect pests of the tropics and their control. Cambridge University Presss; 746 pp.

Ghabbour, S. 1. (1991). Towards a zoosociology of soil fauna. Revue d'Ecologie et de Biologie du Sol, 28: 77-90.

Ghabbour, S. 1.; Rizk, M. A. and Mikhail, W. Z. (1992). Bilan hydrique de quelques invertébrés hypoges de Ia region de Mariout (Egypte). Le cas du carfard des Sables *Heterogamia ~yriaca* sauss. Bilan hydrique du cafard des sables en Egypte. *(15)*: *353*-368.

climatic conditions, soil texture, pathogen sensitivity to heat, population density of pathogen.



was decreased from 99 individuals in cultivated plots to 81 individuals in fallow plots to 42 individuals in soirization plots. But the population density of Collembola was positively with temperature in soirization plots. The total numbers of collombola *(Entomob?ya dilifusi* and *Friesa clavista)* was *85* decreased to 61 in fallow plots and more decreased to 62 in cultivated plots.

Ghabbour (1991) pointed out, soil fauna can division to trophic groups in different ecosystems. These trophic groups: herbivores (potential agricultural pests), carnivores (natural enemies of herbivores), and detrItivons (essential of soil fertility were will represented under all crops, (Mikhail *et al.*, 1998, Hussein *et al.*, 1998).

Table (3), Fig (2) shows results of the breakdown of soil fauna of the present study into the three main functional (trophic) groups; carnivores, herbivores and detntivores; under different treatments. Generally, the solarization treated plot has low numbers of soil fauna and these numbers become slightly high when another plots was cultivated, but higher number was obtained in fallow plots (control).

Detritivores were less abundant in the plots solarized but were abundant in cultivation and fallow plots due to the surplus amount of water used and subsequent increase in soil humidity as well as the higher availability of organic matter. The abundance of herbivores is higher in fallow plots du to the surplus amount of litter and weeds. The herbivares were less abundant in the cultivated plots but its more decreased in solnzed plots. Carnivores are equal in both fallow and cultivated plots, but they are decreased in solarization plots.

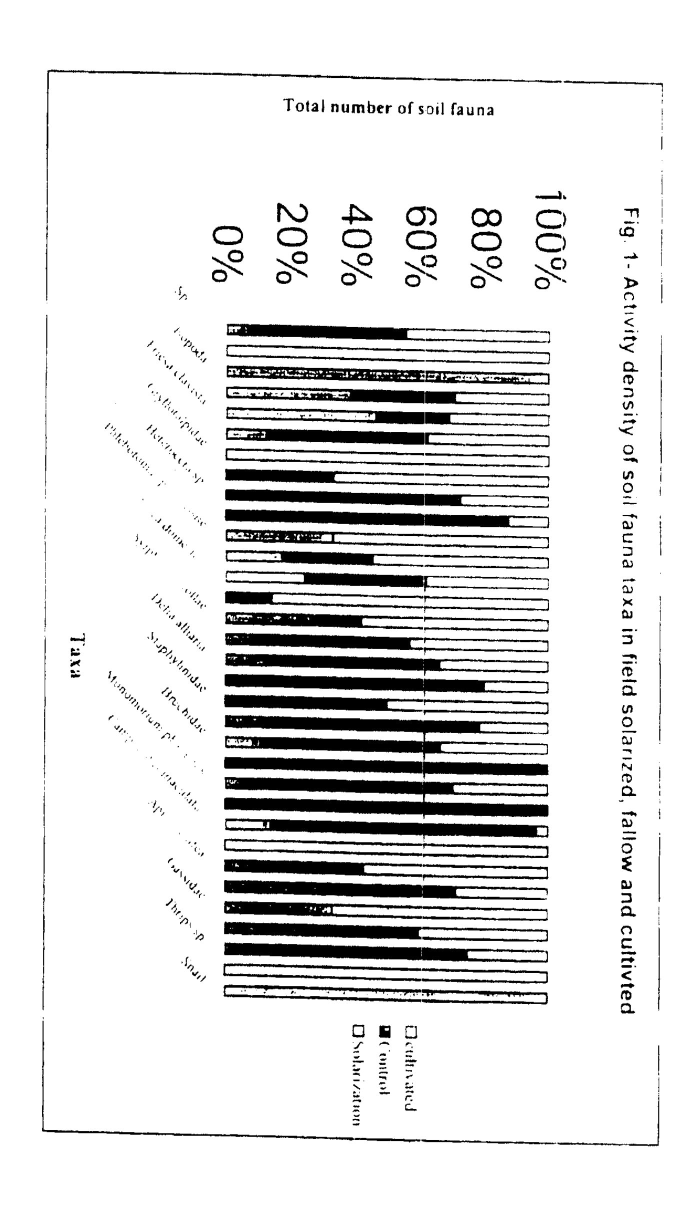
Table (3): Breakdown of soil fauna into the three main trophic groups, cornivores, herbivores and detritivores.

	Cornivores	Herbivores	Detritivores	Total
Solarization	14	33	123	160
Fallow (control)	45	150	159	354
Cultivated	57	86	139	281

DISCUSSION

The main effort for improving solarization has focused in recent years on combining it with reduced dosage of pesticides and with biocontrol agents but especially with organic amendments which produce volatiles. Beneficial effects of soil solarizations for the control of nematodes and soil-borne diseases (Hagan and Gazaway 1996). Direct effect of soil solarization was indicated by Pala and Cinar (1999) investigated the effect of soil solarization on strawberry root-rot *(Rhizoctonia solani* KUhn.), solarization significantly reduced decease incidence.

A major limitation of this method (solarization) is its dependency on climate. YUcel *et al.*, (1999) show that the success of solarization depend on



In these study found that some soil fauna group; Formicidae *(Monomorium pharaonis)* and *Camponotus macu/at us* the activity density of soil fauna decreased after solarization from 110 individuals in fallow plots to 41 individual in cultivated plots to 15 individuals solarization plots. Also some species was disappear like Neuroptera *(Chrysopa vulgaris)* and Symphyta *(Cephidae* sp.). The total number of population density of soil fauna Diptera

Table (2) Activity density of soil fauna taxa in field solarized, follow (control) and cultivated with tomato.

Taxa	Solarization	Control	cultivated
Spiders	4	30	27
Mite	0	0	[illegible]
Crustacea			
Isopoda	2	0	[illegible]
Collembola			
Entomobrya dillfusi	58	48	44
Friesa clavista	27	13	18
Orthoptera			
Acrididae	1	4	[illegible]
Gryllotalpidae	0	0	[illegible]
Lepidoptera			
Agrotidae	0	1	[illegible]
Heterocera sp.	0	8	[illegible]
Rhopalocera	0	7	1
Diptera			
Psychodidae			
Phlebotomus papalassie	1	0	2
Chironomida			
Chironomus sp.	10	16	[illegible]
Muscidae			
Musca domestica	11	17	[illegible]
Tachinidae			
Goniacapitata	0	1	[illegible]
Syrphidae			
Syrphus corrollae	5	3	[illegible]
Eumerus amoenus	2	6	[illegible]
Delia alliaria	*13*	38	26
Coleoptera			
Coccinellidae	0	4	[illegible]
Staphylinidae	0	[illegible]	[illegible]
Curculionidae	8	29	[illegible]
Bruchidae	2	10	[illegible]
Anthicidae	0	1	[illegible]
Hymenoptera			
Formicidae			
Monomorium pharaonis	11	85	46
Cataglyphus bicolor	0	2	[illegible]
Camponotus maculatus	4	23	[illegible]
Symphyta			
Cephidae	0	0	[illegible]
Apidae			
Apis mellifea	1	2	[illegible]
Dermaptera			
Labidura riparia	3	2	[illegible]
Homoptera			
Gassidae	1	0	[illegible]
Aphididae	2	1	[illegible]
Thysanoptera			
Thripcidae			
Thrips sp.	1	2	[illegible]
Neuroptera			
Chrysopa vulgaris	0	0	[illegible]
Snail	3	0	[illegible]
Total	170	353	281

RESULTS

Table (1): Mean of Minimum and maximum soil temperatures (°C) from solarized and unsolarized (control) plots (°C).

Soil Depth (cm)	Max. temperature			Min. temperature		
	Solarized	Unsolauized		Solarized	Unsolauized	
		Cultivated	Fallow		Cultivated	Fallow
1	57.1	50.0	51	46.4	45.9	45
10	44.1	35.4	37	41.8	34.9	34
20	36.6	33.0	35	33.4	31.4	32
25	34.8	31.6	33	31.9	30.5	30
30	34.4	31.3	32	30.6	28.9	30

Mean soil temperatures at 5, 10, 20, 25, 30 cm depths from solarization, cultivated and unsolarized (fallow) are given (Table 1) temperature in solarized plots for each depth was higher than in unsolarized plots. Temperature small difference between cultivated and fallow areas varied by depth.

In order to investigate the changes in activity density of soil fauna, the number of individuals was collected in difference polts.

Table (2). Fig. (1) shows results of activity density of species and/ or higher taxa of soil fauna collected in the present study from the three treatments; solarization, cultivated plots (with tomato); and fallow plots (control).

Solarization will also affect the densities and pattern of distribution of the trophic (functional) groups among soil animals.

The aim of the present study is to study the effect of solarization in population species diversity of soil fauna.

MATERIALS AND METHODS:

The study area:

The experiment was conducted in Fayoum Governorate in Demo village , during the period between June and September 2000. An aria of 240 m^2 was selected and divided into 6 equal plots. Two plots were cultivated with tomato , two another plots fallow (control), and two another covered with a polyethylene sheet 0.03 mm (solarization).

Solarization treatment:

A soil solarization was performed for a period of 8 weeks. Soil to be solarized was crumbled to a depth of at least 30 - 40 cm. This is achieved by deep cultivation followed by harrowing and light rolling. The field was irrigated to a depth of 50 - 60 cm before mulching. After that the soil surface was covered with 0.03 mm thick transparent polyethylene sheets. During solarization,, at 2 week intervals plots were irrigated.

Fallow plots, did not ploughed but irrigated at the sam time with another plots. The cultiveted plots with tomato as normal cultivation treatment.

Method of sampling soil fauna:

The soil fauna were collected from the study area by the pitfall trap method as described by Slingsby and Cook (1986) and Southwood and Henderson (2000). In this method, the number of individuals trapped is primarily dependent on their locomotory activity (Greenslade and Greenslade 1983, Kromp 1990, Mikhail 1993). These are called activity densities rather than population densities (Kromp 1990, Mikhail and Hussein 1997) and con not be related to abundance per unit area (Kromp *1990)* but are taken as number per trap (Mikhail and Hussein (1997).

Ten traps were used in each sampling date in the different plots. The number of fauna collected is the total number of individuals /10 traps.

EFFECT OF SOIL SOLARIZATION FOR SOIL STERILIZATION ON POPULATION DENSITIES OF SOIL FAUNA AT DEMO, FAYOUM GOVERNORATE, EGYPT

Marguerite A.Rizk
Fayoum Agricultural Research station,
Agricultural Research Center, Fayoum, Egypt.
Email:reta49@usa.net

ABSTRACT

Soil solarization was used to control root-knot nematodes, soil borne diseases Root-rot disease, weed control. Solarization is method to control soil biota by solar heat and does not involve chemicals or toxic material, Is economical and easy to achieve. This method has some advantages in Mediterranean and tropical regions where hot summers occur.

The aim of this study was to investigate the effect of soil solarization on activity density of soil fauna. Soil solanzation was done by covering irrigated soil with transparent 0.03 mm thick polyethylene sheets for 8 weeks during July -August.

Population dynamics of soil fauna was observed and recorded before and after solarization. The success of solarization depends on climatic conditions, soil texture, and sensitivity of soil fauna to heat and humidity. The true spider decreased from 2.5 in control to 1.6 under solarization, Collembola increased from 0.5 to 1.2 but Formicidae decreased from 1.5 to 0.6 and Orthoptera decreased from 1.3 to zero. This means that inoculation by useful species of soil fauna must be a necessary step to improve the value of soil solarization.

Key words: Soil solarization, soil fauna, activity, temperature, fallow, cultivated, density.

INTRODUCTION

Population species diversity of soil fauna are influenced by agricultural practices (Waliwork 1976). The practices that advere affect fauna population include: mechanized land clearing and ploughing (Smith 1988. Roberts and All 1993, Bigler *el al.,* 1995a and b) and indiscriminate use of agrochemicals (Smart *et al., 1995).*

Also, soil and crop management techniques that favour and enhance the activity of soil fauna include mulch farming (Maia *et al.,* 1991) no-tillage (Rizk and Mikhail, 1999), cover crops (Buntin *et al.,* 1994), agroforestry, other eclogicall compatible farming systems (Lee, *1995)* and type of irrigation regimes (Rizk *et al.*, 2000). On the other hand solarization, environment can have a positive, negative or neutral effect on pest-soil fanua and biological control interaction.

REFERENCES

Butler R.E.. (1959). "Periodic Phonene in land — spaces as a basis for soil studies". C.S.I.R.O. soil Fub.. 14. PP. 20 (outed from karale. RI. and Goosen,D.

FAO (1991)." Guidelines for soil description ". Rome: FAO.

Goosen. D.. (1967). "Aerial Photo-Interpretation in soil survey", FAO soil Bull.6 , FAO, Rome.

IBM Cairo Scientfic Center (1985). A multi-objective model for planning the development of "New Lands" in Egypt. Part II: Model Application, (Technical Report 008 March 1985).

Jackson M. L. . (1967). "Soil chemical analysis". Prentice Hall Inc. Englewood cliffs . N.S. constable and Co. Ltd. . London.

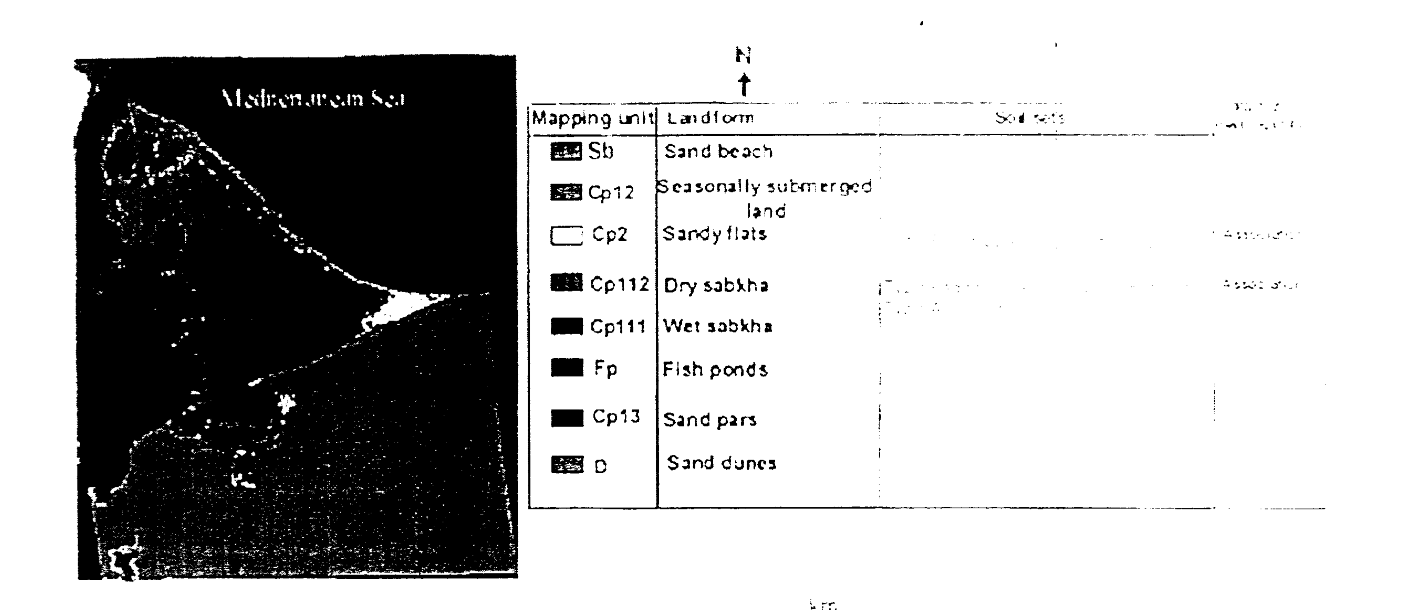
Ministry of inhabitants, infrastructure and new urban societies (1996). "Development and reconstruction map of the Arab Republic of Egypt in the year 2017. General Report of December 1996.

Regwa. (1981). Reconnaissance soil survey of North Sinai area. Report Performed for GARPAD.

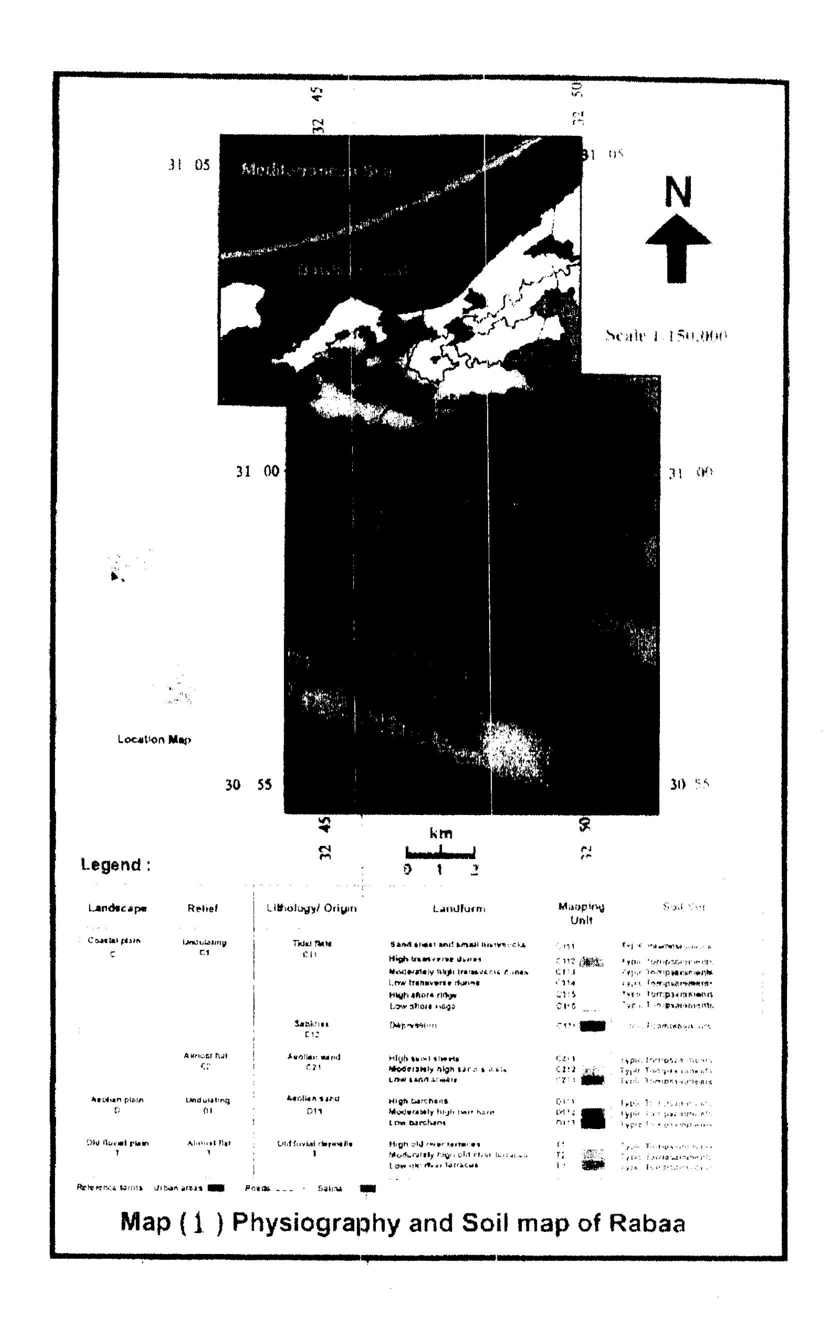
Soil Survey Staff,(1999). "Soil Taxonomy. A basic system of soil classification for making and interpret surveys, second Edition, Agriculture Handbook No.436. U. S. D. A. .Natural Resources conservation service.

Sys, C., Van Ranst, E. , Delaveye. J. and Beernaert . F.. (1993). Laud evaluation part I, II and III . Agricultural publication No. 7. GADC Brusssels. Belgium. 197 PP.

Vink.A.P.A., (1963). "Aerial Photographs and soil sciences". Unesco Report. Paris (C. F. Sadek. S.A. 1980).



Map (2) Physiographic and soil map of El - Tina plain



Map (1) Physiography and Soil map of Rabaa

Table (3) current suitability classes in Rabaa

Mapping unit	S1	S2	S3	N
C_{112}			potato - Ground nut -Cabbage - onion - Green pepper - citrus - olives - water melon - Alfa Alfa	
C_{113}			potato - Ground nut -Cabbage - onion - Green pepper - citrus - olives - water melon - Alfa Alfa	
C_{114}			potato - Ground nut -Cabbage - onion - Green pepper - citrus - olives - water melon - Alfa Alfa	
C_{121}				all corps
C_{211}		Cabbage-Green pepper-citrus	potato - Ground nut - onion - olives - water melon - Alfa Alfa	
C_{212}		Cabbage-Green pepper citrus	potato - Ground nut - onion - olives - water melon - Alfa Alfa	
C_{213}		Cabbage-Green pepper-citrus	potato - Ground nut - onion - olives - water melon - Alfa Alfa	
T_2		Cabbage-Green pepper citrus olives	potato - Ground nut - onion - olives - water melon - Alfa Alfa	
T_3		Cabbage-Green pepper citrus olives	potato - Ground nut - onion - olives - water melon - Alfa Alfa	

Table (2): Land characteristics of the mapping units in the studied area

Land characteristics	a - Rabaa									b - El-Tina plain	
	C_{11}			C_{12}	C_{21}			T		CP_1	CP_2
	C_{112}	C_{113}	C_{114}	C_{121}	C_{211}	C_{212}	C_{213}	T_2	T_3	CP_{112}	CP_2
Topography (T)											
Slope (P)	5	5	5	2	2	2	2	4	4	2	2
Wetness (W)											
Flooding (F)	Fo	Fo	Fo	Fo	Fo	Fo	Fo	Fo	Fo	Fo	Fo
drainage (d)	w	w	w	w	w	w	w	w	w	w to p	m to w
Physical charac. (S)											
texture/structure (t)	Fs	Fs	Fs	Fs	Fs	Fs	Fs	Fs	Fs	C-60, s to LS	LFS to Cs
Soil depth (h)	150	150	150	150	150	150	150	150	150	50-110	90-110
$CaCO_3$ % (k)	0.40	0.59	0.98	0.686	0.335	0.24	1.03	0.38	0.235	1.29 to 33.5	1.77
Gypsum % (y)	0.48	1.03	1.04	9.34	1.08	0.56	0.77	1.12	1.35	6.61	6.89
Fertility (F)											
CEC meq./100 gm. (C)	-	-	-	-	-	-	-	-	-	3.31-32.85	2.1 to 14.87
Base saturation % (e)	-	-	-	-	-	-	-	-	-	7.9	8.9
O.C % (0-25 cm) O	0.4	0.55	0.197	0.098	0.23	0.32	0.55	0.44	0.44	2.5	2.79
Salinity and alkalinity (N)											
EC ds/m 0-50 cm (Z)	0.46	0.53	1.47	22.79	0.35	0.23	0.33	0.32	0.25	58.1 to 104.31	61.485
ESP % (n)	-	-	-	-	-	-	-	-	-	10.7	16.5

Texture/structure:
Fs: Fine sand
C-60, s: clay blocky structure
LS: loamy sand
CS: coarse sand
LFS: loamy fine sand

Drainage:
w: well drained
m: moderately drained
w to p: well to poor drained
m to w: moderately to well drained

Flooding:
Fs: Fine sand
Fo: No flooding

Table (1): Physico chemical characteristics of some representing profiles in the studied area.

Prof. No.	Depth cm.	CEC	$CaCO_3$	ESP	pH 1:2.5	EC ds/m	Soluble cations				Soluble anions				Texture	Macro nutrients			Micro nutrients			
							Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	$SO_4^{=}$		N	P	K	Fe	Zn	Cu	Mn
a - Rabaa																						
1 (C_{121})	0-60	-	0.61	-	7.5	22.79	4.65	4.78	32.1	0.43		0.2	30.3	11.64	sandy	73.5	5.6	20.7	1.8	0.42	0.12	1.1
2 (C_{112})	0-30	-	0.44		8.0	1.05	0.39	0.17	0.43	0.02	-	0.2	0.55	0.26	sandy	105	17.2	5.85	3.3	0.34	0.02	1.3
	30-65	-	1.31	-	7.8	2.11	0.58	0.066	1.73	0.025		0.15	1.25	1.001	sandy	-	-	-	-	-	-	-
	65-150	-	1.32	-	7.5	3.89	2.13	0.92	1.35	0.063		0.15	2.05	2.26	sandy	-	-	-	-	-	-	-
3 (C_{212})	0-20	-	1.13		7.8	0.41	1.13	0.15	0.13	0.025	-	0.25	0.1	0.085	sandy	94.5	9.3	9.36	3.4	0.36	0.14	1.8
	20-150	-	0.26	-	7.8	0.27	0.15	0.13	0.096	0.017	-	0.25	0.05	0.093	sandy	-	-	-	-	-	-	-
4 (T_2)	0-30	-	0.44	-	7.9	0.32	0.097	0.135	0.1	0.005	-	0.15	0.05	0.137	sandy	84	2.1	4.68	2.7	0.36	0.02	1.3
	30-150	-	0.26	-	7.9	0.34	0.097	0.088	0.13	0.005	-	0.2	0.1	0.02	sandy	-	-	-	-	-	-	-
b - El-Tina plain																						
5 (CP_{112})	0-10	10.61	0.44	7.9	7.1	147.7	1.63	6.59	106.2	0.96	-	0.048	115.2	0.132	sandy clay loam	126	26.1	34.32	1.1	0.62	0.62	2.4
	10-45	2.09	0.87	17.2	7.4	12.23	0.218	0.33	4.29	0.035	-	0.28	4.09	0.755	sandy	-	-	-	-	-	-	-
	45-60	Shells layer			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	60-90	2.11	1.31	27.4	7.8	27.8	0.289	1.21	13.5	0.081	-	0.04	10.67	4.37	sandy	-	-	-	-	-	-	-
	+ 90	Water table			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6 (CP_{112})	0-10	18.9	0.33	11.4	7.1	142	1.397	28.94	147.6	1.55	-	0.072	162	17.42	silty loam	63	11.5	52.26	2.5	2.6	0.98	2.0
	10-20	13.56	0.44	24.2	7.5	79.5	2.38	12.21	61.25	0.105	-	0.035	59.35	16.76	sandy	-	-	-	-	-	-	-
	20-45	16.21	5.48	33.3	7.7	62.5	1.89	8.22	37.25	0.293	-	0.039	39.0	8.614	sandy	-	-	-	-	-	-	-
	45-85	14.87	2.74	26.9	7.8	93.2	0.64	14.49	89.76	0.825	-	0.0495	62.7	42.97	sandy	-	-	-	-	-	-	-
	85-120	Shells layer																				
- (CP_2)	0-10	Salt crust																				
	10-25	18.92	0.44	9.0	7.5	147.7	0.58	33.31	150.0	4.0	-	0.16	160.0	27.73	clay loam	84	5.7	553.8	6.6	3.0	3.08	6.8
	25-70	32.85	2.19	10.5	7.5	125.0	1.09	51.69	223.13	3.6	-	0.22	225	54.29	clayely	-	-	-	-	-	-	-
	70-110	43.5	0.22	3.5	7.8	136.3	6.98	57.47	276.0	8.32	-	0.36	288.0	60.41	clayely	-	-	-	-	-	-	-

governed the land suitability for most crops are texture / structure and soil fertility.

2.1 El-Tina plain

The data of Table (2) shows that the main limiting factors in El-Tina plain are, soil salinity and alkalinity, soil depth, soil texture/ structure, gypsum content, soil drainage and soil fertility. Therefore, these soils are actually unsuitable for all tested crops and orchards.

2.2. Potential suitability:

After getting rid off or reducing the limitations to the proper limits, most of the field crops, vegetables and selected orchards can be cultivated in Rabaa region. Sandy texture, loose structure of Rabaa region can be improved by adding organic residues and applying green manure to encourage aggregation and to keep enough amount of water arround root zone.

The first step to improve land qualities in El-Tina plain is supplying with a continuous water source as a fish ponds for several years to reduce salinity and sodicity to acceptable limits and leaching processes are required in addition to gypsum requirements and drain installation. Its recommended to cultivate cabbage, Green paper, Olives and Citrus in Rabaa region, but in El-Tina plain it is recommended to cultivate the tolerant crops such as sugar beet, barley and cotton.

images, combined with results of reconnaissance visit, three sample areas were chosen, some mini pits were taken in consideration to represent different landuse and landscape pattern. The first and second sample areas were located in Rabaa, meanwhile the third sample area is located in El-Tina plain.

18 soil profiles were studied to represent different mapping units. Detailed morphological description were done in each profile based on FAQ (1991).

5. Physical and chemicals analyses:

Physico chemical properties were determined according to Jackson 1967. The soils are classified according to soil taxonomy (1999).

6. Land suitability classification:

Land suitability classification was done according to Sys et al., (1993) and ARC/INFO system was used to classify different land qualities for defining the land suitability of 9 crops.

RESULTS AND DISCUSSION

1. Physiography and Soils:

Based on the aerial photo-interpretation, satellite images, field work and laboratory analyses table (1), physiographic and soil map legend had been formulated, for both Rabaa and El-Tina plain Maps (1&2).

The dominant soil sets in Rabaa are Typic Torripsamments which form > 93 % of the investigated soils, while Typic Psammaquents are occurred as associated soils in depression of coastal plain (about 6 %).

The soil sets in El-Tina plain are Typic Psammaquents, Gypsic Haplosalids and Typic Aquisalids in soils of dry sabkha (Fluvio -marine deposits), while Typic Psammaquents and Sodic Torripsamments in soils of sandy flats (marine deposits).

2. Land suitability:

Land suitability classification proposed by Sys et al., (1993). was used to evaluate the investigated soils of different mapping units for determination of the suitable crops to be cultivated in such soils under reclamation, this method depends on making a comparison between land characteristics or qualities and crop requirements.

<u>2.1. Current suitability</u>

Table (2) shows the data of landscape and soil data according to Sys et al., (1993) for both Rabaa and El-Tina plain. The data of these tables are extracted from the soil profile description and the analytical data.

<u>2.1.1. Rabaa:</u>

Nine crops were selected and evaluated according to their requirements with the land characteristics of the mapping units of Rabaa area to recognize the current suitability and limitation factors. The current suitability classes in Rabaa area are shown in table (3). The most important limiting factors

environment., soil formation, classification and potentialities to evaluate soil fertility and productivity.

The aim of this work is to use aerial photo-interpretation, remote sensing data and GIS to produce land suitability maps for Rabaa and El-Tina plain regions, North Sinai. These maps will be helpful for investment and development planning.

MATERIALS AND METHODS

1. Used remote sensing Materials:

Satellite images were used in the study of El-Tina plain area, while aerial photographs were used in the study of Rabaa area. The first area is covered by two TM images of path 176 and Rows 38 and 39, imaged in April 1990. The studied area is located in North Sinai, and between Longitude 32 15 , 33 10 and Latitude 3 1 00 31 10.

For Rabaa area, 21 panchromatic aerial photographs, scale 1: 30,000 have been used. The photographs are distributed in 5 runs and were taken during the year of 1994.

2. Preliminary processing of satellite images:

Digital processing was run on the used of sub-scene as follows applying PCI software package:

2.1. Geometric correction

The geometric correction was carried out by using topographic maps at scale of 1: 50,000.

2.2. Image enhancement:

Image enhancement was followed using Histogram equalization and Brightness / Contrast techniques. It resulted in a spectrally enhanced image which was used as a guide for field investigation.

The preliminary interpretation of the satellite image included unsupervised and supervised classification. Tins upervised classification was performed as a preliminary step for image interpretation. The signature corresponding to the 22 classes were compared with signature of ground truth sites., using both histogram and mean plots in addition to image alarm. Combining the unsupervised classes and training sites made it possible to merge classes for obtaining reliable supervised classification.

3. Aerial photo-interpretation:

A loose mosaic was laid out to identify the main land types and followed by detailed photo-interpretation. The photographs were studied stereoscopically and further division were made. Physiographic analysis was followed for this purpose (Butler, 1959. Vink, 1963 and Goosen, 1967). The main elements used were: Slope, relief and grey- tone.

4. Field work:

A reconnaissance visit was performed for the study area to get aquented with different landscape features, land forms and broad soil patterns. On basis of the preliminary interpretation of aerial photographs and satellite

CURRENT AND POTENTIAL LAND SUITABILITY OF SOME AREAS IN NORTH SINAI, EGYPT (RABAA AND EL-TINA PLAIN)

F. Hanna*, Sh. Sadek*, A. Gad** and Noha Hola**
* Cairo University, Fac. of Agric.
* * National Authority for Remote Sensing and Space Sciences (NARS S).

ABSTRACT

Aerial photo-interpretation techniques, satellite image, field works and the analytical data were used for soil mapping and suitability maps for Rabaa and El-Tina plain area, North Sinai. The main identified geomorphic units in Rabaa area are, the coastal plain, aeolian plain and old fluvial plain, while the coastal plain and aeolian plain are the identified ones in El-Tina plain. The dominant soil sets in Rabaa area are Typic Torripsamments which from > 93 % of the studied area and Typic Psammnaquents are occurred as associated soils (about 6 %), while soil sets in El-Tina plain are Typic Psammaquents and Sodic Torriopsamments in sandy flats of marine deposits, Typic Psammaquents, Gypsic Haplosalids and Typic Aquisalids in dry sabkha of fluvio marine deposits. Land characteristics of the different mapping units were matched with the requirements of nine selected crops to identify the land suitability for these crops, the obtained results showed that, there are wide variations due to the different land characteristics of different mapping units. Current land suitability maps were produced for Rabaa area and the study recommended some land improvement practices to reduce or to remove soil limitations especially in El-Tina plain and potential suitability was recommended.

Key words : Soil mapping, Land suitability, Remote sensing, Rabaa and El-Tina plain, North Sinai.

INTRODUCTION

Sinai peninsula represents a promising and strategic region for urban extension. It covers about 61.000 km^2 which represent about 6% of the Egyptian Territories. The northern territories have potential qualities for agriculture, fisheries and as summer resorts (Regwa, 1981 and IBM Cairo scientific center, *1985)*.

The northern parts will be provided with Nile water through ElSalam canal which will pass below the suez canal after being mixed with drainage water from El-Serw and Bahr Hadous drains at the eastern delta. This will be carried during a national project (Sinai Development) aims to reclaim 400.000 feddans to be irrigated from El-Salam canal (Ministry of inhabitants, infrastructure and new urban societies 1996). El-Tina plain and Rabaa regions form 130.000 feddans (60.000 in El-Tina plain and 70.000 feddans in Rabaa regions). Planning agriculture projects in north sinai needs information about

المنازل الريفية كملاجئ تحمى تنوع العناكب فى النظم الزراعية بدلتا النيل– مصر

عبد الخالق محمد حسين، هشام كمال الدين الحناوى

تهانى محمود عيد، سمير ابراهيم عبور

تم بطريقة البحث والإلتقاط اليدوى أخذ عينات من عناكب المنازل الريفية من ٣ قرى بالمنوفية بمصر وأظهر البحث أن التنوع الأحيائى لهذه العناكب يشمل ظهور ١٢ عائلة هى:

Lycosidae, Linyphiidae, philodromidae, Miturgidae, Clubionidae, salticidae, Theridiidae, Agelenidae, pholcidae, Filistatidae and *Oecobiidae.*

وأن العائلة السائدة والأكثر تواجداً هى " salticidae " وتشمل ٤٧% من مجتمع العناكب تحت الدراسة يليها عائلتى *Theridiidae* و *pholcidae,* بنسبة ١٣% ثم *Clubionidae* بنسبة ١٠% من المجتمع الكلى لعناكب المنازل.

واستناداً إلى دراسات متزامنة (للمؤلفين) ١٩٩٩ لمسح العناكب فى زراعات الخضر والمحاصيل الحقلية الملاصقة والمحيطة هذه المنازل الريفية إتضح أن:

أ- هناك أربع عائلات فقط لم نجدها إلا فى المنازل الريفية وهى:
Pholcidae, Filistatidae, Pisauridae and *Oecobiida.*

ب- تشترك ٨ عائلات (من جملة ١٢ عائلة) فى تواجدها فى كلتا البيئتين (المنازل الريفية) و (المزارع المحيطة) ولكن بنسب مختلفة، فعائلة *Lycosidae* توجد بنسبة سائدة فى المزارع تصل إلى ٨٢% (حسين ١٩٩٩) لكنها تتواجد فى المنازل بنسبة ضئيلة (٦ ر.%) كما أظهرت هذه الدراسة.

ت- العائلة *Gnaphosidae* تتواجد بنسبة محسوسة ومتوازنة فى كلتا البيئتين ١ ر. ١% و ٥ر ٣% فى المنازل والمزارع على الترتيب.

وهكذا فإن المنازل الريفية يمكن إعتبارها مأوى يحمى العناكب ضد بعض الضغوط البيئية مثل الإستخدام المفرط للمبيدات الذى قد يضر هذه المفترسات الهامة لمعظم حشرات وآفات المزارع المحيطة.

REFERENCES

Alderweireldt, M. and J.P. Maelfait (1989): Recommendations for the conservation of endangered lycosid spiders (Araneae, Lycosidae). Proc. Symp. Invertebrates of Belgium, :183 - 187.

Edwards, G.B. (1993): Crossopriza lyoni and Smeringopus pallidus : cellar spiders new to Florida (Araneae : Pholicidae). Entomology Circular, Gainesivlle, 361: 2.

El-Hennawy H.K. (1998): Annotated checklist of Egyptian spider species (Arachnida: Araneae). Serket, 1(4 - 5): 1 - 49.

Ghabbour, S.I.; A.M. Hussein and H.K. El-Hennawy (1999): Spider populations associated with different crops in Menoufiya Governorate, Nile Delta, Egyp. Egypt. J. Agric. Res., 77 (3): 1163 - 1179.

Hancock, E.G. (1992) : Pholcids from Scotland. Newsletter, British, Arachnological, Socity. No.65 : 6.

Hussein A.M. (1999): Seasonal abundance and daily activity patterns of spider fauna in some vegetable crops in Menoufiya Governorate, Egypt. Egypt. J. Agric. Res., 77 (2): 677 - 689.

Hussein, A.M.; H.K. El-Hennawy and A.A. Sayed (1998): Biodiversity of spiders (Araneae) in the Western Desert of Egypt in relation to agriculture and land reclamation. Bull. Fac. Agric., Univ. Cairo, 49 : 597 - 610.

Hutchinson, R. and Belanger, G. (1999) : Some spiders found in houses, Chemin de La Savane, Gatineau, Quebec, Canada, Nouv' Ailes, 9 (2): 4 - 6.

Jennings, D.T. and McDaniel, I.N. (1988): atrodectus hesperus (Araneae: Theridiidae) in Maine. Entomological News , 99 (1): 37 - 40.

Jimenez, M.L. (1998) : Arachnofauna associated with housing in La Paz, B.C.S., Mexico. Folia Entomologica Mexicana Publ. No.102: 1 - 10.

Miyashita, K. (1987): Egg production of Achaearana tep ida rio rum (C.L. Koch) (Araneae, Theridiidae) in the field in Japan. J. Arachnology 15 (1): 130 - 132.

Moritz, M. and Pfuller, R. (1988a) : Achaearanea tabulata (Araneae Theridiidae) - first record for Europe. Entomologische Nachtrichten und Berichte 32 (1): 44.

Moritz, M.; Levi, H.W. and Pfuller, R. (1988b) Achaearanea tabulata, a new spider for Europe (Araneae, Theridiidae). Deutsche Entomologische Zeitschrift 35 (4): 361 - 367.

Palacios, C. and Jimenez, M. (1997) : The presence of cockroaches in dwellings in La Paz, Baja California Sur, Mexico. Southwestern Entomologist 22 (2): 243 - 246.

Rubia, E.G.A. and K.L. Heong (1990): Role of polyphagous predators in the rice ecosystems. Pest control council of the Philippines, Annual Convention, 1 p.

Strickman, D.; Sithiprasasna, R. and Southard, D. (1997): Bionomics of the spider, Crossopriza lyoni (Araneae, Pholcidae), a predator of dengue vectors in Thailand. J. Arachnology 25 (2): 194 - 201.

Tanaka, K. (1989) : Seasonal life cycle of the house spider, Achaeranea tepidariorum (Araneae : Theridiidae) in northern Japan. Applied Entomology and Zoology 24 (1): 117 - 125.

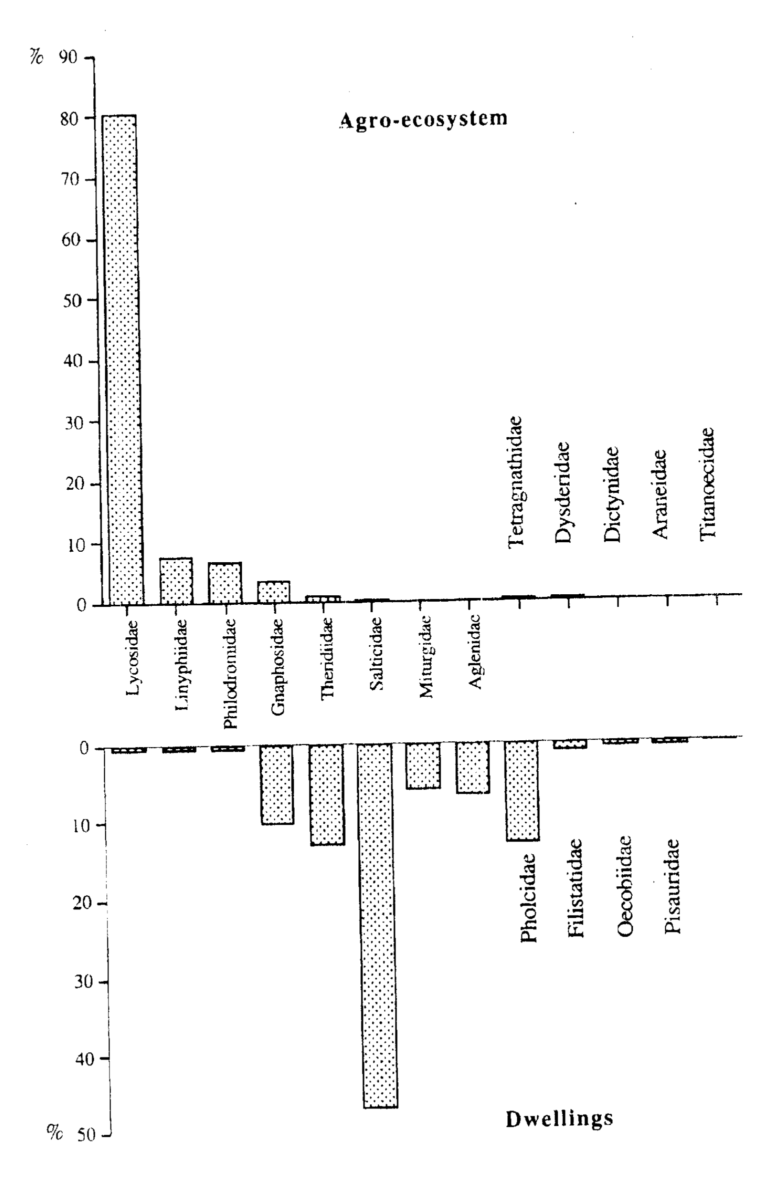


Fig. (1) Percentages of spider families among the whole population in both agro-ecosystem and dwellings in the study area.

Table (2) : Total numbers of spider families and species obtained from dwellings of studied rural houses.

Date	Total No.	Spider family	M	SM	F	SF	J	Species
Nov. 1998	2	Salticidae				1		*Hasarius* sp.
				1				*Plexippus* sp.
		Agelenidae		1			2	*Tegenaria* sp.
Feb. 1999	14	Gnaphosidae		1				
		Pholcidae					2	
		Salticidae	1				1	*Hasarius adansoni*
			2		1			*Plexippus paykulli*
		Theridiidae			2	1		*Theridion* sp.
May 1999	25	Agelenidae			3			*Tegenaria* sp.
		Filistatidae			1			
		Pholcidae	3		3		3	
		Salticidae	2					*Hasarius adansoni*
			2		1	1		*Plexippus paykulli*
							3	
		Theridiidae	1		2			
Aug. 1999	22	Agelenidae					2	*Tegenaria* sp.
		Filistatidae					1	
		Pholcidae		1				
		Pisauridae		1				
		Salticidae	1			1	1	*Hasarius adansoni*
			3		9		1	*Plexippus paykulli*
		Theridiidae			1			*Theridion* sp.
Oct. 1999	16	Aglenidae		1	1		1	*Tegenaria* sp.
		Miturgidae					1	*Cheiracanthium* sp.
		Oecobiidae			1			*Oecobius putus*
		Pholcidae	2		1		5	
		Salticidae			1			*Hasarius adansoni*
					2			*Plexippus paykulli*
Nov. 1999	39	Gnaphosidae	6		1		3	
		Pholcidae			1		1	
		Salticidae	5	1	2	1	3	*Hasarius adansoni*
			3	1	2	1	2	*Plexippus paykulli*
		Theridiidae	1		4	1		
Mar. 2000	50	Miturgidae	3		3		9	*Cheiracanthium* sp.
		Gnaphosidae			1			
		Linyphiidae	1					
		Lycosidae						
		Philodromidae					1	*Thanatus* sp.
		Salticidae	7		3		1	*Hasarius adansoni*
		Theridiidae	2		5		5	*Plexippus paykulli*
					9			

M : Male, SM : Sub adult male, F : Female, SF : sub adult female, J. Juvenile

(1999), who studied the spider fauna associated with 18 field and vegetable crops cultivated around these studied houses using pitfall traps. Agelenidae occurred in both hab itats, but it was represented by the genus Tegenaria in dwellings, and with Textrix in agro-ecosystems.

The two species of Salticidae family : Hasarius adansoni and plexippus paykulli, also never occurred in agro-ecosystems, while the other two species Thanatus spp. (philodromidae) and cheiracanthium spp. (Miturgidae) occurred in both habitats. Jimenez (1998) studied composition of arachnid fauna in 32 houses in Mexico; 42 species of Araneae were collected.

Table (1) : Spider families and species obtained from the study area from :

Plantations *		Dwellings	
Lycosidae		Lycosidae	
	Lycorma ferox		
Linyphiidae		Linyphiidae	
	Erigone dentipalpis		
	Prinerigone vagans		
	Erigone spp.		
Philodromidae :		Philodromidae :	
	Thanatus albini		*Thanatus albini*
Gnaphosidae		Gnaphosidae	
	Zelotes complex		
	Trachyzelotes sp.		
	Setaphis subtilis		
	Micaria sp.		
Miturgidae		Miturgidae	
	Cheiracanthium sp.		
Dictynidae			
Salticidae		Salticidae :	*Hasarius adansoni*
			Plexippus paykulli
Theridiidae		Theridiidae :	*Theridion* sp.
Dysderidae			
	Dysdera sp.		
Agelenidae		Agelenidae	
	Textrix sp.		*Tegenaria* sp.
Titanoecidae			
	Titanoeca sp.		
		Pholcidae	
		Filistatidae	
		Pisauridae	
		Oecobiidae :	*Oecobius putus*

* According to Ghabbour *et al.* (1999) and Hussein (1999).

species Plexippus paykuliji represented 10 %, which is described as resident in houses.

Strickman et al. (1997) studied Grossopriza lyoni (Pholcidae) as a common inhabitant of homes in the rural village in Thailand. The results of the study suggested that C. lyoni could form an important component of integrated control of Aedes aegypti mosquito. Edwards (1993) recorded presence of C. lyoni as a new species of cellar spiders in Florida, USA.

Ghabbour et al. (1999) and Hussein (1999) recorded that Lycosidae family was the main dominant family representing 82 % of the spider populations in the agroecosystems. This study showed that the family is a rare one with only 0.6 % of the whole population. This result may be due to the difference in habitats and in nature of spider species or families.

According to Hussein (1999) the sex ratio as (females : males) was 1: 2.6 in the agro-ecosystems nearly the same studied area (Menoufiya), while this study showed sex ratio in dwellings was 1 : 7. The percentage of juveniles in agro-ecosystems showed 26 %, a near or similar ratio as their percntage in dwellings, being 28.6 % of the whole population (Table 2). Hussein et al. (1998) studied spiders families and species in western desert of Egypt. It was reported that Lycosidae and Philodromidae were common, while Theridiidae and Thomisidae were rare families.

Comparison of spider families in dwellings with those of vegetable plantation fields in the same governorate and those of desert ecosystems, showed that spiders of dwellings characterize for such habitat. These studies showed that the dominant spiders families in agro-ecosystems are extremely rare in dwellings, e.g., Lycosidae and Philodramidae. On the contrary, Salticidae was the rarest family in vegetable plantations while it was the dominant one in dwellings (Fig. 1).

The four families which wee only found in dwelling habitats Pholcidae, Pisauridae, Oecobiidae and Filistatdae. The family Gnaphosidae was the only one which occurred almost equally in both habitats, houses and plantations. At any rate, if the two habitats harbour different species, some are common for both. This does not preclude the fact that human dwellings constitute an effective refuge for spider biodiversity within the region as a whole.

Studied population: Tegenaria is the main genus belonging to the family Agelenidae and Cheiracanthium is the dominant genus of Miturgidae. Theridion is the main genus of Theridiidae .

The rarest families were: pisauridae, Oecobiidae, Linyphiidae, philodromidae and Lycosidae which occurred with a low percentage of 0.6% for each. Oecobius putus is the dominant species of Oecobiidae family.**Thanatus was the only one identified among philodromid spiders.**

The four characteristic families for such habitats are then: pholcidae, Filistatidae, pisauridae, and Oecobiidae. They never occurred in agro-ecosystems in the same area, according to Ghabbour et al. (1999) and Hussein

City, Mexico. Moritz and Pfuller (1988b) recorded presence of the species Achaearanea tabulata (Theridiidae) as a first record in dwellings of Berlin in 1984, that was the first record for Europe. Jemings and McDaniel (1988) recorded that a female of Latrodectus hesperus (Theridiidae) was introduced to Maine (USA) from Arizona among household goods. They added that a nucleus of a breeding population was formed in the Maine dwellings. Hutchinson and Belanger (1999) studied some spiders found in houses, they gave a list of spiders of homes in Canada. Cheiracanthium spp., Pholcus spp., Tegenaria domestica and Salticus spp. were mentioned.

Tanaka (1989) studied the seasonal life cycle of Achaearanea tepidariorum in Japan. It was reported that it is the common species frequently associated with human dwellings.

The aim of this study is to survey the spider fauna in dwellings of rural areas in Menoufiya Governorate, especially that we previously have conducted a survey for the spiders in different crops in the same area. No survey of the spiders in dwellings in Egypt has been conducted before (El Hennawy, 1990).

MATERIAL AND METHODS

Collecting spiders by visual search and hand picking was used to collect wandering spiders or the web spinning ones from the studied houses from 3 villages El-Moselha, Kafr El-Moselha and El-Raheb, about 2 km each, away from Shebein El-Kom, the main city of Menoufiya Governorate. The villages represent a rural area surrounded by farms cultivated by different vegetables and field crops. The houses were built of old raw mud bricks. The owners are the farmers who take care of their cattle in a special space inside the same dwellings. Sampling was carried out from all the rooms of houses, especially the stores of food stuff materials. Catching mainly concentrated from the above or top corners near the ceilings. Samples were directly preserved in 70 % ethyl alcohol, then subjected to idenlification into families and species. Adults and sub-adults were differentiated into males and females, while juveniles were isolated to study the age structure. Sampling duration lasted in November 1998, February, May, August, October, November 1999 and March 2000.

RESULTS AND DISCUSSION

Results of Table 1 showed that the population of dwellings spiders is represented by 12 families : Lycosidae, Linyphiidae, Philodromidae, Gnaphosidae, Miturgidae, Salticidae, Theridiidae, Agelenidae, Pholcidae, Filistatidae, Pisauridae and Oecobiidae

Salticidae is the main dominant family (Fig. 1). Two species belonging to this family were identified, Hasarius adansoni and Plexippus paykulli. Salticidae represent 47 % of the whole population. Theridiidae and Pholeidae recorded similar values of 13 % of the spider population, followed by Gnaphosidae 10%, Agelenidae 6.45 % and Miturgidae 6 % of the whole

Most of the species collected belonged to the families Gnaphosidae 12%, Miturgidae 10 %, Theridiidae, Salticidae and Pholcidae 6 % for each.. The

RURAL DWELLINGS AS REFUGES PROTECTING SPIDER BIODIVERSITY IN NILE DELTA AGRO-ECOSYSTEMS

A.M. Hussien[1], H.K. El-Hennawy[2], Tahany M. Eid[3] and S.I. Ghabbour[4]

1. Plant Protection Research Institute, Agriculture Research Center, Giza, Egypt
2. 41, El-Manteqa El-Rabia St., Reliopolis, Cairo 11341, Egyp
3. Dept. of Zoology, Fac. of Science, Menoufiya Univ., Shebin El-Kom, Egypt
4. Dept. of Natural Resources, Ins. of African Research and Studies, Cairo Univ. 12613, Giza (Cairo) Egypt

ABSTRACT

The visual search and hand picking sampling method was used to collect a total of 168 individuals representing 12 families of spiders from dwellings of 3 villages in Menoufiya Governorate. The dominant families were : Salticidae with 47 % of the studied collected spiders, followed by Theridiidae and Pholcidae 13 %, Gnaphosidae 10 %, Agelenidae 6.6 % and Miturgidae 6 %. The species identified of these families were : Hasarius adansoni and Plexippus paykulli (Salticidae), Theridion spp. (Theridiidae), Tegenaria spp. (Agelendiae). The rare families obtained in this study were: Philodromidae, represented by 1 individual, Oecobiidae, Pisauridae and Filistatidae 2 individuals each. Four families of spiders were only found in dwellings habitat: Pholcidae, Pisauridae, Oecobiidae and Filistatidae. Eight families (from a total of 12) of spiders occurred in both habitats, dwellings and agroeco-systems, with considerable differences in percentages of occurence. Hence farmers houses could be considered as refuges protecting spiders against some ecological impacts such as intensive use of pesticides.

INTRODUCTION

The importance of spiders as biological control agents in their environments is well known for their as predators against different pests. They occur in wide variety of habitats (Alderweireldt and Maelfait, 1989), and they are the most abundant polyphagous predators among natural enemies (Rubia and Heong, 1990). Spiders in farmers homes may play an important role against some insects e.g. house flies, mosquitoes, weevils, cockroaches and moths attracted to the house lights from mearby farms. Spiders are important also because of their ability to introduce themselves into new habitats by goods transportation.

Moritz (1988a) reported that the spider Achaearanea nipponica (Theridiidae) has become a junior synonym and it is presumed to be a widely introduced synanthropic species. Hancock (1992) studied the different species of Pholicd spiders in the dwellings of Scotland. Miyashita (1987) studied density and biology of a Theridiidae spider in a house in Japan. Palacios and Jimenez (1997) recorded 2 species of spiders Heteropoda venatoria and Latrodectus mactans as natural enemies for cockroaches in dwellings of La Paz

Homewood K. & Rodgers W A. (1984) : "Maasailand Ecology pastoralist development and wildlife conservation in Ngorongoro Crater Area, Tanzama. Cambridge Univ. Press.

Jacobs A. IL (1975): "Masai pastoralism in historical prespective." in "Pastoralism in Tropical Africa." ed. Monad T. Oxford Univ. Press.

Konckzacki Z. A. (1978) : "The economics of pastoralism : a case study of Sub-S aharan Africa. Frank Cass

Pearce F (1995): "Selling wildlife short" New Scientist No.2, Sept.1995.

Timberlake L. (1985): Africa in crisis: the causes, the cures of environmental bankruptcy." Earthscan.

(Summary of studies done by Arhem, Homewood & Rodgers, 1981; Homewood & Rodgers, 1984a, b,* Homewood, Rodgers & Arh em, 1987; Rodgers & Homewood, 1986 cited in Homewood & Rodgers 1984)

It's important to avoid biases in studies. Insufficient studies on other impacts such as tourism in NCA have led many ecologists to aportion the blame to the Masai although a quick look at Masai Mara, for instance, would show that tourism impact is quite devastating if not rationalised. The visitors to Masai Mara's twelve lodges and camp sites increased by 260% between 1977 and 1989, reaching 190,000. A survey in 1994 found that the 12 tourist camps and lodges round the Masai Mara reserve consume more than 1200 tonnes of wood a year (Pearce,1995).

It's inevitable to solve the problem away from the problem out of the concept of " integrating parks and pastoralists ". This concept is centred around the problem of reconciling nature conservation with indigenous people's land tenure and use. The benefits to the Masai could be:

(1) Wildlife utilisation fees.
(2) Direct income from park tourism.
(3) Better infrastructure : e.g water supply

The benefits to conservation is clear in the stop of the killing of wild animals. Besides, it's no mere accident of history that many of the most spectacular wildlife protection areas m East Africa are found in territories previously part of Masailand.

The decision of excluding or permitting the access of the Masai livestock to the habitat of NCA should depend on well quantified "ecological" and "sociological" data about:

(1) The nature of change in Masai society and its relations with the environment.
(2) The potential for competition or sharing of resources by wildlife and domestic stock.
(4)The influence of external pressures on the system.

I totally agree with Homewood and Rodgers (1984):
"The joint land use is the best option in the long run for both pastorallsts and wildlife, and a more robust solution than exclusive use for either alone."

REFERENCES

Anderson, D.M. (1984) : "Depression, dust bowel, demography and drought : the colonization state and soil conservation in East Africa in the 1930s. African Mfairs,83 (332), 321-43.

Homewood K. & Rodgers W A. (1984) "Pastoralism and conservation" Human ecology vol.12, No.4.

Homewood K. & Rodgers W A. (1987) : "Pastoralism, conservation and overgrazing." in Conservation in Africa: people, policies and practice. eds Anderson D.& Grove R. Cambridge Univ.Press.

"in past years competition between African and European producers under a colonial adrinistration might have provided a strong (however unconscious) incentive to discredit pastoralist management in areas other than those of wildlife interest". (Anderson,1984)

It's clear that the Masai were forced to neglect their traditional systems of herd management and to adopt alternative models which were mostly devastating to the physical environment.

Colonial image of the Masai has continuedto influence government policies towards wildlife conservation until recently until government policies started to realise the importance of offering them a greater participation in decision making and compensating them especially after the 1970s when systematic slaughtering of rhinos by Masai used to be a common form of protest against land alienation for wildlife preservation.

Masai in Ngorongoro Crater area (NCA)

NCA is a joint wildlife conservation / pastoralist land-use area in northern Tanzania, adjacent to the Serengeti plains and part of the ecological unit exploited by the Serengeti wildlife population migrations. It used to support 18.000 resident Masai and their livestock. It's a UNESCO World Heritage site combining world- famous archeological and paleontological sites with extra ordinary geological, ecological and wildlife diversity.

The 18.000 Masai pastoralists were expelled with their livestocks because of alleged impact on conservation value in the mid 1980s. This situation was frequently repeated since the 1970s. The outcome was a protest expressed in the form of killing rhinos and poaching elephants. Scientific studies of pastoralist ecology in the area contradicts the suspicion of pastoralist damage. The main points which support this conclusion are:

(1) Pastoralists, livestock and wildlife have coexisted in the area for over 2,000 years; pastoralist grazing and burning activities have helped to shape the area's present highly valued landscape.
(2) Livestock numbers monitored for over 20 years have fluctuated but show no overall trend of increase.
(3) Wildlife populations have undergone a dramatic increase over the same period, making the idea of adverse competitive impact of livestock dubious if not untenable.
(4) Disease interactions between cattle and wildlife populations favour the latter.
(5) There is no evidence to bear out suggested changes in vegetation composition whether in pastoralist-occupied areas or in areas from which pastoralist stock have been excluded for 10 years or more.
(6) The NCA shows negligible erosion. Rates are lower than for all surrounding areas despite the greater geomorphologic and topographic predisposition of the area to erosion."

typical family of 8-10 persons owns 5-6 donkeys, 125-140 head of cattle, 150-200 sheep and goat. 57% to 60% of the cattle are adult milk cows on which the family depends for daily subsistence. 80% of the Masai annual diet is fresh on curdled cow's milk (occasionally supplemented with steer's blood). Cows are rarely slaughtered for meat and steers are raised mainly for communal ceremonial feasts, at which they are sacrificed and their meat consumed a community ritual.

The constraints in the development of that system of "pastoral diet" of Masai were three:

(1) the relatively rich and extensive grasslands traditionally occupied by Masai
(2) the lack of political centralisation - before colonialism - that might have necessitated exploitation of alternative foods.
(3) the historical absence in their area of any trading networks that may influence their self-sustaining economic practices.

It's worth noting that although they used to feed on high fat content meals, they had never suffered coronary heart diseases as the cholesterol level is always low in their blood, the cause for this is thought to be the high level of Ig Aipha-immunoglobulin which allow the absorption of animal fats. This trait is thought to be genetically acquired due to their practice of subsisting mainly on cows milk for over a millennium.

By the beginning of the 17th Century the Masai occupied Ngorongoro Crater area and Serengeti plains in Northern Tanzania. Much of the economics and history of Masai and other Masai speaking people during 18th and 19th centuries consists of semi pastoral groups attempting to expand by raiding and warfare into the richer grassland plains occupied by the pastoral Masai. (Jacobs ,1975) When European colonialist came to East Africa, they took it for granted that the Masai are "aggressive" "predatory" "ferocious" "warlike" inhibiting any settled cultivation in the area and attacking Farmer neighbours and that their pastoralist type of life necessitates raiding other tribes to replenish their herds.

"The Masal country has at present the disadvantage that its inhabitants are purely pastoral, and hence there is no food or cultivation in the country, though the soil is rich and the country fairly watered. The warlike instincts of the Masai, moreover, render them at present an obstacle to peaceflil development, and a terror to the more industrious and agricultural tribes around them." (Lugard,1893)

In 1890 the greatest rinderpest epidemic then subsequent small pox outbreaks caused the Masai to lose large areas of the dry season grazing meadows for the sake of European settlement and the systematic encroachment of their neighbour farmers by the beginning of the 20th century. The European settlement policies denied the Masai access to the high potential grazing areas they owned before. This affected their herd management practices and livestock as well.

resulting in lower rates of production per animal but a higher overall output of subsistence products per uhit area.

(ii) A system where stocking rates are higher than optimum for both commercial and subsistence management, where all measures of productive output are low and continue to show a steady decline with increasing grazing pressure. Poor stock condition is an indicator of poor range condition; removal of stock and consequent relaxation of grazing pressure leads to a smooth return to highly productivity by any management criterion

(iii) A 'crashed system which has been pushed over its critical threshold bringing about the collapse of both plant and herbivore populations. In this case it requires more than just removal of stock to get the system to 'jump' back to its former high productivity. These are the cases rightly labelled seriously or even irreversibly degraded.

(iv) The low plant/high animal biomass phase of a continuously fluctuating system m which the lag in herbivore population response to resource availability produces recurrent oscillations. Poor stock condition is followed by their emigration or die off, which leads to plant recovery. (Homewood & Rodgers,1987)

Nevertheless, this ambiguity of having many defmitions of overgrazing doesn't prove that pastoralists don't induce damage to rangelands. It only draws attention to the care in applying the overgrazing concept and point to the need of integrating ecological and socio-econonuc methods to reach an objective verdict about pastoralists' effect on rangeland and subsequent effect on wildlife conservation.To do that, a comprehensive data should be collected on:
"desertification, overstocking, actual livestock numbers, their meahing in terms of densities, the actual impact of veterinary care on stock populations and the efficay of imported range management techniques."
(Sandford, 1984 cited in Homewood&Rodgeis, 1984)

Environmental history of Masai

Masai used to inhabit the Great Rift Valley areas of Kenya and Northern Tanzama. There used to be about 226,000 people in the 1960s. Their dietary practices are one of the most important traits by which they see themselves as set apart from other people. Their pastoral diet mainly consists of milk, meat and blood of their livestock. They never killed wild animals except when there's a fartine. Now they kill rltinos for example as a way of protest to the political decisions of banning them from the lands they used to graze in hundred of years ago. Pastoral Masai possessed strong prohibition against the eating of agricultural and other non pastoral food. They used to insist on their pastoral diet reinforced by certain religious and cosmological beliefs.

Their economy is cattle based consisting mainly of zebra cattle, sheep, goats and donkeys. Until 1970s pastoral Masai used to possess on the average 14 head of cattle per capital (Jacobs 1975). They used to be very wealthy as a

One of the main characteristics of pastoralist livestock ecology and management is risk avoidance which can be expressed in terms of stock management to include the following strategies as stated by (Homewood & Rodgers 1991):

? access to high-potential drought refuges, usually highland or swamp pastures

? maintaining a flexible mixture of stock species with different feeding, ranging, production, disease- and drought-resistance, and reproductive characteristics. Small stock are commonly important in post-disaster herd reconstitution; large stock are the preferred investment once a critical threshold of stock holding is passed (e.g. Mace 1988)

? maintaining herds with a high proportion of females capable of rapid reproductive response in the aftermath of disaster.

? maximising stock numbers in the hope of retaining enough to ensure long-term survival of the herd despite heavy periodic drought and disease losses.

? splitting the stock holdings into different herding units depending on species, maturity and reproductive condition and pasturing them in different areas that may be within reach of the same daily base or may be days' journey away.

? social systems of stock loan and redistribution among friends and kinsmen that spread risk over a wider geographical area and range of habitat types and thus buffer disaster.

Misinterpretation of the overgrazing and the carrying capacity concepts

For a long time, the belief in ecological academic circles used to be that pastoralists overstock, overgraze and damage their range while wildlife are existing in harmony with their surrounding. Land use development policies were usually decided on the basis of " the pastoralists' misuse and deteriorating activities to nature". Pastoralism and overgrazing have become synonymous. The concept of" carrying capacity " was frequently interpreted in favour of political decisions based on a view of economic (i.e corumercial) rather than ecological (subsistence) carrying capacity.

The idea of carrying capacity implies that the environment is capable of supporting a set number of grazing animals, at stdcking levels; above carrying capacity there will be environmental damage. It's nearly impossible to have an average fixed figure of carrying capacity of grazing systems where rainfall is highly unpredictable and variable in space and time as the case in arid and semi-arid regions in Africa where pastoralists usually live. Consequently, it's impossible to maintain an optimum average stocking level without exceeding carrying capacity.

Overgrazing has always been the instant accusation against pastoralism in Africa although the diagnosis of overgrazing has always been so" full of pitfalls "that any of the following cases is likely to be labelled overgrazed:

(i) A system with a subsistence stocking rate higher than the commercial,

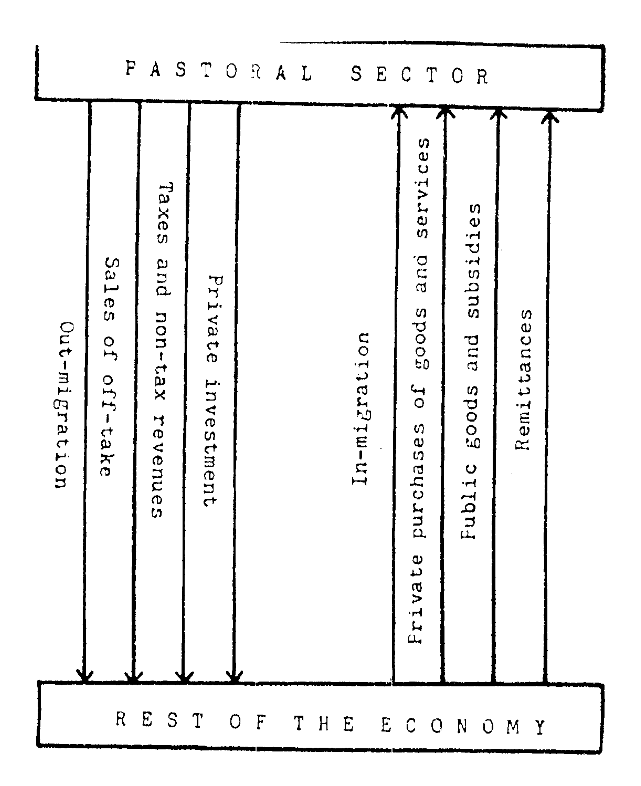


Fig.2: The links between the pastoral community and other sectors of the economy .

The sources of disequilibrium for the "idealised model" (Fig. I) are the "human population growth, the existence of links with the rest of the economy, and the intensity of cyclical change". (Franzisket 1978).

They were all taken in considerations when adjustments of the idealized model were adopted to get the "reahstic model". Details of such adjustments are in (Franzisket 1978).

This is how economists look at pastoralism. It's clear that ecologists and conservationists would agree with the "interventions" concept but from different assumptions where the simple methods of production and the very limited range of natural resources pastoralism is considered as an example of a system in which the "Tragedy of the Commons" (Harden,1968) is an expected occurrence. This very nature of "intervention" is what created problems for pastoralists in Africa not because of being wrong in itself but because of emotional biased judgements and the continuous neglecting of the "Interparticipatory" approach in decision making.

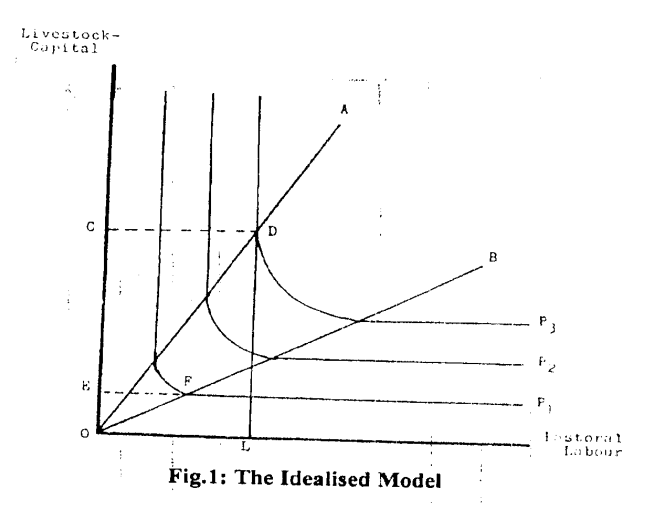


Fig.1: The Idealised Model

"The system thus reaches a position in which both the human and the animal populations show a zero rate of growth and, unless there is interference of an exogenous nature, it approximates a steady state condition. The equality between the total annual output and the off-take of the pastoral economy, and consequently an absence of saving, which would lead to livestock-capital formation, are a logical corollary. As long as the rangeland does not impose a limit, the variable of decisive significance, in this version of the model of a pastoral economy, is the human population. It is this factor which imposes an ultimate limit upon the system's growth." (Homewood *etal* 1987).

This theoretical model can fit the pastoral life of Masai 150 years ago and it shows the possibility of absence of over exploitation in the supposed circumstances. To express the reality of the modem world the "realistic" model is adopted where no assumptions of a closed economy exists but the pastoral society is treated as one of the sectors of an open economy and called "pastoral sector". The five variables of the "idealistic" model are corrected. That "pastoral sector" has relation to the rest of the economy of which it's a part. A generalised schematic representation of the links between the pastoral community and other sectors of the economy are represented in Fig.2

(2) The range is a "common property resource". Its use is free within the limits of its availability.
(3) The pastoral society consists of family units who maintain themselves chiefly by livestock-raising.
(4) The set of priorities discernible in pastoral behaviour reflects the herders' desire to maxirhise their expected welfare
(5) Some of the pastoralists' social values, which have been formed under the impact of environmental pressures, are important determinants of their economic and fertility behaviour.
(6) Apart from efforts to achieve dietary sufficiency pastoralists have no direct control over their own mortality." (Konczack, 1978).

The model is theoretical as it does not deal with facts as presented by the experience of our present world but still it can be a framework for a more realistic model.The "realistic model" assumes that population growth is zero and analyses the relationship between the off-take and the herd according to the following equation.

T =Ta+Tm+Tn
Where T = total off-take

Ta = the part of total off-take which causes reduction in livestock and depends on decisions of pastoralists (e.g. meat consumption)
Tm = the part of the off-take which leaves the herd size unaltered (e.g. milk consumption)
Tn = losses of animals due to natural causes

Tm is treated as a constant proportion of animal population which is naturally unrealistic due to the variability of effects of disease, drought, accidents or attacks by predators. Equilibrium of the system requires stability of livestock numbers (Pa), which is achieved when the annual increase in livestock population due to fertility equals the rate of mortality hence,

$$\frac{\Delta P^a}{P^a} = 0$$

Since the system is a closed one and there's no place for money on the outside world in this model. The herder has the choice to divide his time between effort devoted to herding on one hand and leisure on the other hand. Effort is the only input which represents an actual cost. Other inputs, such as forage and water, are free goods assuming that natural resources are plentiful which a real fact in old historical pastoralism is. Assuming rationality on the pastoralist's part, he would expand output until the marginal revenue and the marginal cost of his operations in terms of effort became equal. (See fig. 1)

PASTORALISM VERSUS CONSERVATION IN AFRICA A CASE STUDY OF THE MASAL IN NGORONGORO CRATER AREA

Ragy Halim

The "crisis" in Africa is recently enunciated in different terms, whether sheer human suffering and the tragedy of famine, the threat to wildlife or the spread of desertification. The Europeans interest in conserving the wildlife and habitats of Africa has a long history of ignorance of the successfiil and traditional ways by which African ssurvived and kept survival of their plants, creatures and soil to live on.

Many of the prescriptions for environmental management and conservation made by development experts proved to be damaging for both people and wildlife of Africa due to that neglecting of the indigenous knowledge and alienating indigenous methods of local people. One clear example of that is the Masai in Ngorongoro Crater area. This essay aims at discussing pastoralism as a traditional way of land use and of life. Is it with or against wildlife conservation taking the Masai of Ngorongoro as an example.

I'll start with defining pastoralism in socio-economic context showing the variables and components of the "pastoral economy" and explaining the nature of risk avoidance strategies adopted by pastoralist's livestock ecology. Then I'll discuss the vagueness, uncertainty and ambiguity of the concept of "overgrazing" and "carrying capacity" when used to describe the way pastoralists affect environment. After that I'll give a briefmg of the environmental history of pastoralist Masai. At the end I'll tackle the problem of the Masai in Ngorongoro crater area as a study case as Ngorongoro is one of the leading multiple land use examples of a national park in Africa which shows clearly the conflict between pastoralism and conservation.

Theoretically, pastoralists can be divided into transhumants and nomads. Transhumants tend to live in one place and take or send their herds off to the same distant pastures for part of each year (Timberlake,1985). Nomadic herders spend all their time with their herds and follow no yearly pattern. In practice the two types are hard to differentiate.

To understand the theory of pastoral economy we have to tackle the "idealised" model of a pastoral economy (Konczack, 1978) which assumes the presence of five variables in the pastoral economy: (1) human population (2) the range (3) The quantity of animals (4) the off take (5) the cost of producing the off-take. The first two factors are exogenous while the last three factors are endogenous.The model includes six realities which are assumed to remain unchanged over a long period of time which are:

(1) The range can tolerate a certain annual cropping rate beyond which rapid decline in the plants' regenerative powers occurs.

Herman ,J.R.& Goldberg, R.A. 1985: Sun Weather and Climate.Dover publications ,INC. New York. 360 pages.

Hoyt D.V. and Schatten 1997:The Role of The Sun In Climate Change. Oxford University Press. N.Y.

Lamb.H.H. 1966: Climate of the 1960s, changes in world wind circulation reflected in prevailing temperatures, rainfall patterns and the level of African Lakes. The geographycal journal ,132, 183-212.

The chart of lake levels is after Jean-Claude Olivry and others, 1996, Hydrologie du lac Tchad: Paris, ORSTOM, p. 206.

Reid, G.C. 2000: Solar variability and the earth's climate: Introduction and review. Solar Variability and Climate; Edited by Friis-Christensen, E. , Fröhlich , C. , Haigh, J.D., Schüssler M. and Von Steiger R.. Space Sci.Rev 94, No1-2

Shahin M. 1985: Hydrology of the Nile Basin. Elsevier publishers, Amsterdam-Oxford-New York-Tokyo.

Yousef, Shahinaz Moustafa 1995a: The Downturn of Solar Activity During The Forthcoming Three Cycles. Bull: Fac.Sc. Cairo Univ., 63, pp 185-192.

Shahinaz Yousef 1995b: The Possibility Of Forecasting Nile Floods During The Coming Forty Years. The First Scientific Congress On Science In Service Of Sustained Development of Nile Basin Countries. Cairo 22-24 May.

Yousef Shahinaz . 1996: A Serious Warning of Wide Spread Drought -Flood Hazards 1996-2032 Proceedings of the Big Cities World Conference on Natural Disaster Mitigation, Jan 5-10 Cairo University ,349-358.

Yousef, Shahinaz 1998: A Warning Of Solar Inactivity During the Next Few Decades and Its Influence On IMF And Cosmic Rays. Proceedings of the Third SOLTIP Symposium, Oct 1996. Beijing , pp 569-575.

Yousef S.M 2000: 1997-998 Climate Fluctuations Attributed to The beginning of Intermediate Weak Solar Cycles. Journal of Environmental Sciences, The University of Mansoura - Egypt ,Vol. 20,PP 151-166.

Shahinaz M. Yousef and El Raey M. 1995: Major Solar Episodes Reconstructed Using Records Of the river Nile , Tree-Ring Indices and Sunspot Number. Bulletin De L' Institut D' Egypte. Tomes LXXIV, p76.

Shahinaz M. Yousef & Morsi Amer Mohamed Abdel Aty 2000: The Sharp Rise Of Lake Victoria, A Positive Indicator To Solar Wolf- Gleissberg Cycles Turning Points. Paper I The International Conference For Environmental Hazards Mitigation ICEHM2000. Organized by Center For Environmental Hazards Mitigation. Cairo University, Sept 9-12.

Shahinaz M. Yousef & Morsi Amer 2000: 1997-98 Climate Change ,Marked the End Of The Last Solar Wolf-Gleissberg Cycle And The Beginning Of The Last Solar Wolf-Gleissberg And The Beginning Of Intermediate Weak Cycles Weak Cycles; Confirmation From World-Wide 1997-98 Sharp Rise Or Fall Of Lakes Levels. Paper II. 2nd International conference on Earth Observation and Enviromental Information, 11-14 Nov, Cairo, Egypt.

Lake Chad showed similar response to SST(1870-1960s). Successive La Nina cooling in the Atlantic ocean during period 1998-2001 must have caused good rainy years in El Sahel zone with higher the normal Chari floods leading to the rising of Lake Chads level.

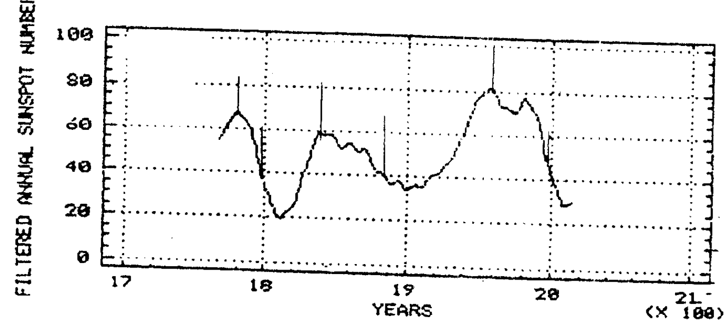


Fig 13: Re-smoothed sunspot numbers showing three Wolf- Gleissberg cycles. The vertical lines indicate the dates of turning points at which sudden rise (or fall) of Lakes occur indicating the onset of climate fluctuations. Note that climate fluctuation(change) occurred in the early sixties just following the maximum of the previous Wolf-Gleissberg-cycle, and consequently must have occurred at pervious maximums around 1780 and 1838-40. At the termination point of Wolf-Gleissberg cycle and the beginning of weak intermediate solar cycles in 1878, Lake Victoria rose sharply indicating the onset of climate fluctuations and the beginning of an era or severe El Ninos and La Ninas causing several decades of drought- flood hazards. Earlier climate fluctuation must have occurred around 1797. Recently, in 1997-98 another sharp rise of Lake Victoria occurred marking the end of the last Wolf-Gleissberg cycle and the start of solar cycle No 23 which has proved to be considerably weaker that its previous cycles. 1997-98 is the onset of climate fluctuation which would be similar to that of 1797. The coming era is believed to be a recurrent of the frequent natural hazards that happened around 1800..Other climate fluctuations occur at the build up of new Wolf-Gleissberg cycles e.g. as happened in 1922. Another similar climate change must have occurred at the end of Maunder minimum (1645-1715)- which coincided with the maximum of little ice age- and beginning of Wolf-Gleissberg cycles

REFERENCES

Burroughs, William James 1994: Weather Cycles, Real or Imaginary?. Cambridge University Press. Great Britain.

Dixey,E 1924: Lake level in relation to rainfall and sunspots. Nature, 114,659-661.

Donaire, Jaun José Sanz 2000: New definition of climate and climate change. Bulletin of the Egyptian Geographical Society, 73, 127-144.

Faure, Hugues and Gac, Jea-Yves 1981: Will the Sahelian drought end in 1985.Nature 291, 475-478.

Garston, Sir William 1903:Adaleel Fi Maward Alalee Eneel. El Mararif press. El Fagala. Egypt.

Gleissberg, W. 1958: The eighty-year sunspot cycle. J.Br.Astr.Ass., 75, 227-31.

evident that the smoothed minimum of Solar Wolf-Gleissberg cycle is 1901 (see Table 1 and Fig (10),while the minimums of sea surface temperature is delayed 5-6 years.

5- To those evidences of solar induced climate fluctuation we can add the measured rise of Lake Chad level to more than six meters above sea level. This cyclic rises of the Lake level was followed by contemporary drop in sea surface temperature (compare figures 9 (of Lake Chad level and fig 10 of SST). As a matter of fact, there is a remarkable similarity between the SST and the patter of the level of lake Chad for the period 1870up till late sixties.

6- The following four meters drop in level of Lake Chad occurred with the following weak solar cycle and was coincident with the sharp rise of temperature of Sorya(a small Spanish town) as shown in fig (11) after Donaire (2000). Indicating that such a climate fluctuation happened few years prior 1900 in some locations on the earth.

7- After the end of the small amplitude solar cycles and beginning of new Wolf- Gleissberg cycle, the level of lake Chad remained moderate.

8- During the maximum of Wolf Gleissberg cycle in the late fifties and the climate fluctuation of the early sixties as manifested with a change in the general wind circulation (Lamb 1966) increased precipitation in the Sahel zone lead to considerable rise in lake Chad level to more than 5 meters above Bol.

9- Drought conditions in the early 1970s affected El Sahel zone considerably. This was reflected so much on Lake Chad level and area as seen in fig 9.

10- The difference between the high levels of the 1870s an1880s and drought levels near the end of the 20th century is about 6.5 meters.

CONCLUSIONS

Climatic fluctuations world wide occur at the turning points of the Solar Wolf-Gleissberg cycles as shown in Table I and fig 13.

Sharp rises in Equatorial African lakes Africa among other rises or drops in lakes and closed seas are evident worldwide. The 1997 sharp rise in Lake Victoria level is an evidence of entering a new climate fluctuation period resulting from the termination of a Solar Wolf-Gleissberg cycle and the beginning of an era of weak intermediate solar cycle which is expected to last for few decades. The expected response of the Equatorial African lakes to solar forcing will be similar to their response between the period 1878-1922. On those grounds , the 1997 sharp rise of e.g. lake Victoria with the start of the present solar cycle number 23 will be followed by a decline leading to harsh drought condition by the end of this 12 year solar cycle(started by the end of 1996). Cyclic variations of water level in sympathy with the following solar cycles are expected to occur. This solar forcing are then expected to end by the termination of this intermediate period of weak solar cycles and the beginning of a new Wolf- Gleissberg cycle with another climate fluctuation expected to happen. However there is a possibility that solar forcing to extend to the first normal solar cycle of Wolf-Gleissberg 80-120 yr. solar cycle.

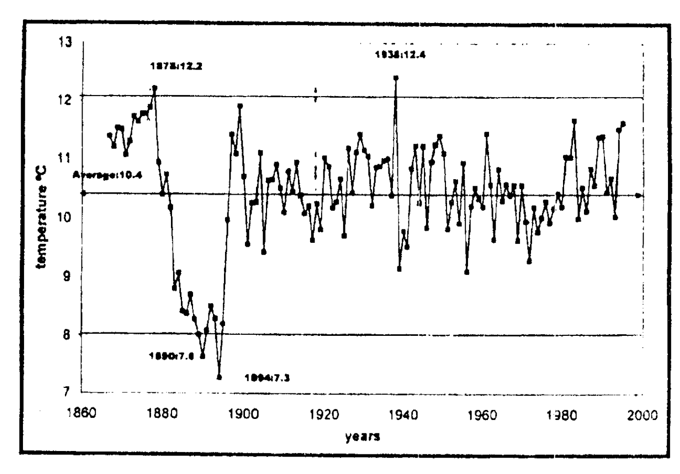


Fig 11: Temperature anomalies in Soria, a small town in Spain. Adapted from Donaire (2000).Notice the 1887 drop of temperature indicating climate fluctuation. Prior to this drop there has been more than a half a degree rise in temperature. Another climate fluctuation occurred in 1894.7 and continued to 1899 as manifested by about 5°C sharp rise in temperature.

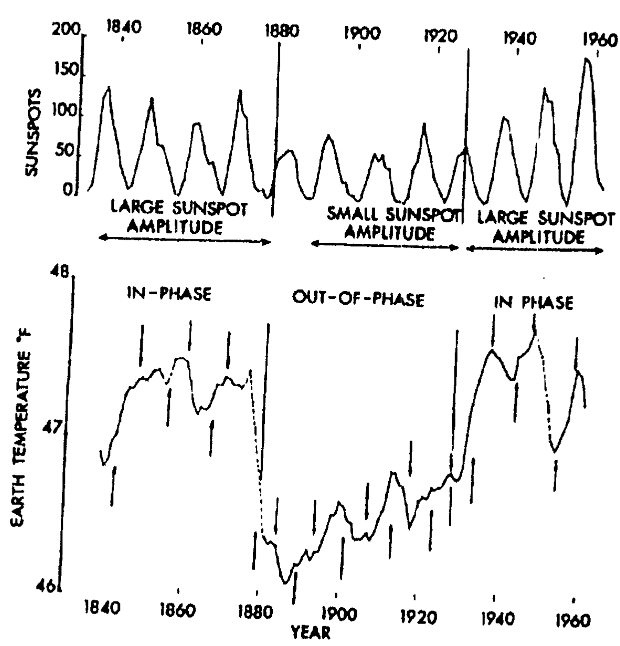


Fig 12 : Air surface temperatures from Edinburgh, Wakefield ,and Greenwich in Great Britain shown with Wolf sunspot Numbers. Temperature appear to be out of phase with solar activity from 1880 to 1930, but in phase for other years. (Adapted from Hoyt and Schatten 1997 and references therein)

4- Notice also the drop in sea surface temperatures SST for each of the three major oceans as well as global SST(fig 10) adapted from Reid (2000). It is

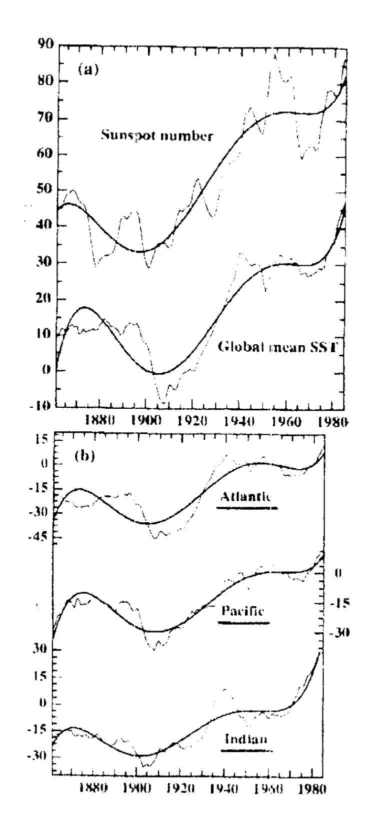


Fig 10: a) Eleven yr. running means of the annual sunspot number (i.e Wolf-Gleissberg cycle) and mean global mean sea surface temperature shown as departures from the 1951-80) average in units of 0.01k (lower light curve). Heavy curves are least squares 7th degree polynomial fits to the data.
b) Same as (a) for the three major basins (after Reid 2000).
Note the striking control of the solar Wolf- Gleissberg cycle on SST of major oceans as well as global mean SST.

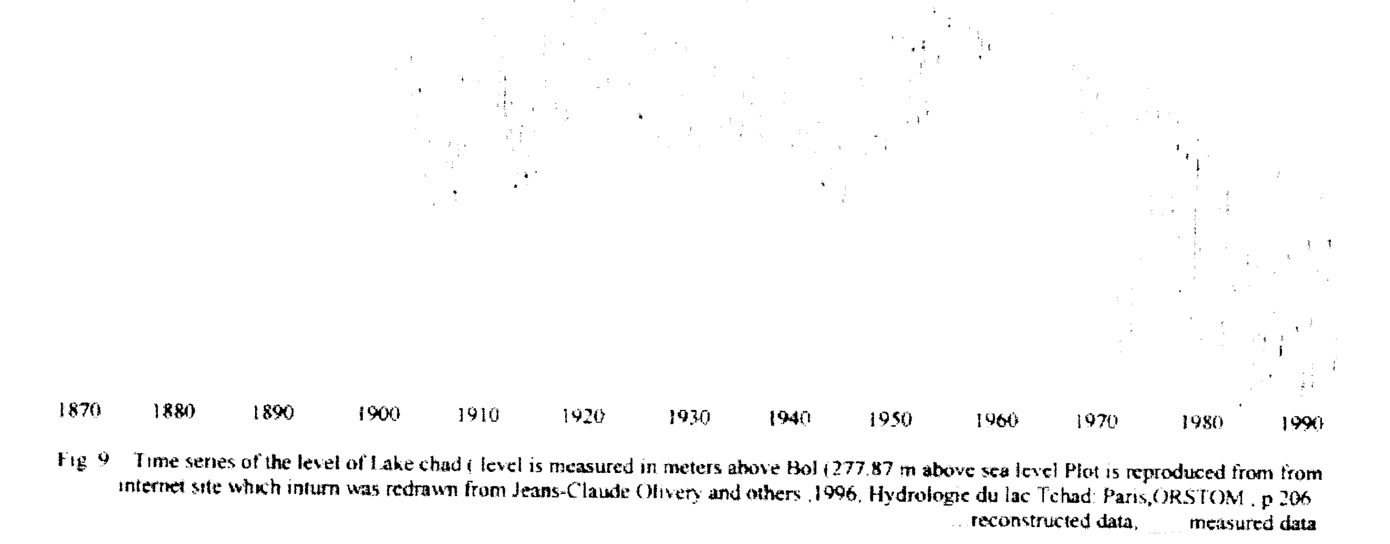


Fig 9 Time series of the level of Lake chad (level is measured in meters above Bol (277.87 m above sea level Plot is reproduced from from internet site which inturn was redrawn from Jeans-Claude Olivery and others ,1996, Hydrologie du lac Tchad: Paris,ORSTOM , p 206
... reconstructed data, ____ measured data

Solar forcing on global parameters and on Lake Chad can be summarized as follows:

1- Notice the end of Wolf-Gleissberg normal solar cycles and the start of weak small amplitude sunspot cycle in 1887 (upper curve in fig 10, a 5 °C drop in air temperature for Soria (a small Spanish town) as shown in fig 11 after Donaire (2000) , as well as a drop of temperature for Edinburgh, Wakefield and Greenwich in Great Britain shown in fig 12 (reproduced from Hoyt and Schatten after their reference).

2- Notice also the drop in sea surface temperatures SST for each of the three major oceans as well as global SST(fig 10) adapted from Reid (2000). It is evident that the smoothed minimum of Solar Wolf-Gleissberg cycle is 1901 (see Table 1 and Fig (10),while the minimums of sea surface temperature is delayed 5-6 years. To those evidences of solar induced climate fluctuation we can add the measured rise of Lake Chad level to more than six meters above sea level . This cyclic rises of the Lake level was followed by contemporary drop in sea surface temperature (compare figures 9 (of Lake Chad level and fig 10 of SST). As a matter of fact, there is a remarkable similarity between the SST and the patter of the level of lake Chad for the period 1870up till late 1960s.

3- Notice the end of Wolf-Gleissberg normal solar cycles and the start of weak small amplitude sunspot cycle in 1887 (upper curve in fig 10, a 5 °C drop in air temperature for Soria (a small Spanish town) as shown in fig 11 after Donaire (2000) , as well as a drop of temperature for Edinburgh, Wakefield and Greenwich in Great Britain shown in fig 12 (reproduced from Hoyt and Schatten after their reference).

Lake Chad has a large drainage basin (1.5 million sq km Landsat images. 90% of Lake Chad's water flows in from the Chari River, at the southeast of the lake. The Chari averaged about 40 billion cubic meters per year from the 1930s to the 1960s, but now averages only about half that.
Lake Chad technically has an outlet to the east, the dry Bahr el Ghazal riverbed-- but the last time the lake was high enough to spill into it was probably in the 1800s.

There is naturally some delay between upstream rainfall and the resulting rise in lake level. About 90% of the rain falls from June to September, but the lake suddenly rises in November as seen in figure 8. Highest lake levels are in December, tapering off slowly for several months, so satellite images are all near the annual peak.

B- Lake Chad level fluctuations

Low-rainfall regions are usually also variable-rainfall regions. On the dry, northeast side of Lake Chad, at the town Bol, rainfall from 1954 to 1972 ranged from 125 to 565 mm (about 5-22 in), averaging 315 mm (about 12.5 in).

The lake is very responsive to changes in rainfall. When rains fail, as in 1972, the lake drops rapidly because annual inflow is 20-85% of the lake's volume.

Fluctuations are not new to Lake Chad. About 10,000 years ago Lake Chad almost filled its present drainage basin, and spilled southwest out the Benue River to the Atlantic. In the last 1,000 years, according to fossil evidence, the lake probably dried out a half-dozen times. (Most of its fish are river-adapted species.) Geologic data, climate data, historical accounts and reconstruction all indicate a higher long-term variability than the relatively short period actually measured. The chart shown here shows levels since the 1870s, from actual measurements and from estimates based on Nile River discharge.

Following highs in the 1870s and 1890s, the lake dropped enough by 1908 to separate into north and south pools, with the "Great Barrier" between. In the 1950s the lake rose enough to flood out irrigation systems, peaking this century in 1962. The lake then tapered off until the early 1970s, when it plummeted. The recent low levels are a concern, and have been monitored through satellite and other means by the Lake Chad Basin Commission and others.

C-Solar Forcing on Lake Chad

What was the influence of solar Wolf-Gleissberg cycles on lake Chad level and how does the level fluctuation be compared with other climate fluctuations on the globe ? In order to do this let us consider solar activity , sea surface temperatures (fig 10) after Reid (2000) and air surface temperatures for Sorya in Spain (Fig 11 after Donaire (2000) and for Edinburgh, Wakefield ,and Greenwich in Great Britain shown in fig 12 (Adapted from Hoyt and Schatten 1997 and references therein)

Lake Chad has a large drainage basin (1.5 million sq km Landsat images. 90% of Lake Chad's water flows in from the Chari River, at the southeast of the lake. The Chari averaged about 40 billion cubic meters per year from the 1930s to the 1960s, but now averages only about half that.

Lake Chad technically has an outlet to the east, the dry Bahr el Ghazal riverbed-- but the last time the lake was high enough to spill into it was probably in the 1800s.

There is naturally some delay between upstream rainfall and the resulting rise in lake level. About 90% of the rain falls from June to September, but the lake suddenly rises in November as seen in figure 8. Highest lake levels are in December, tapering off slowly for several months, so satellite images are all near the annual peak.

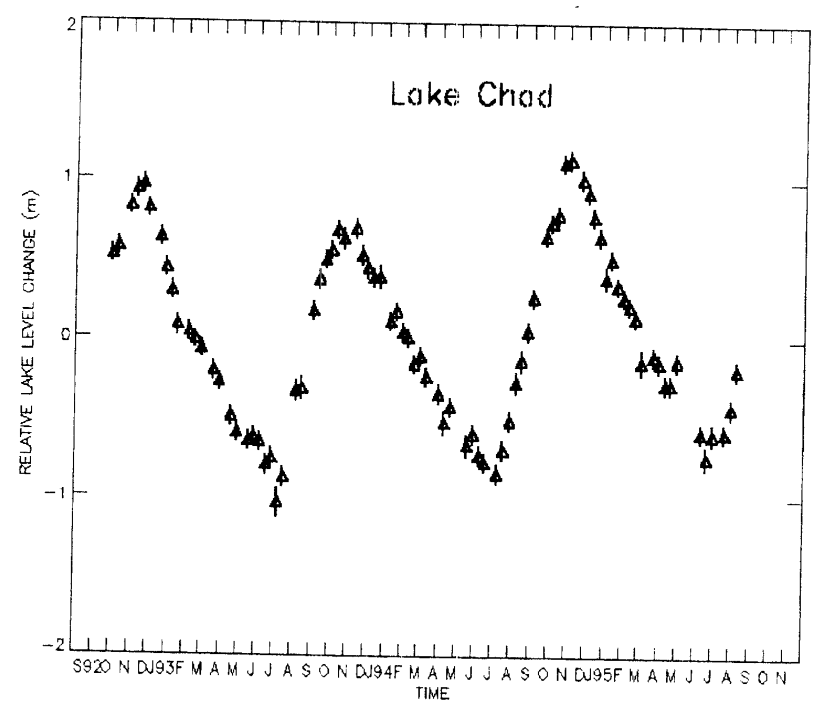


Fig 8: Seasonal variations of lake Chad from September 1992 to

Right on the edge of the world's largest, driest desert-- the Sahara-- there lies a large freshwater lake. Lake Chad borders four countries in West Africa: Nigeria, Niger, Chad, and Cameroon. Lake Chad was once the sixth-largest lake in the world, but persistent drought since the 1960s shrank it to about a tenth its former size.

Since the sharp rise in Lake Victoria level already happened in 1997-98, as mentioned in item 3C, then this is a confirmation of the end of the previous Wolf-Gleissberg cycle and the beginning of a period of weak 12 years sunspot cycles with the following expectations of lakes level:

i) The present drop in Equatorial lakes will continue up till the end of the present 12 yr. sunspot cycle (2008-9) which started (1996-7) causing several years of severe drought conditions in those areas.
ii) A re-rise in the lakes level will follow afterwards attaining its maximum perhaps after 4-5 years from minimum and will remain there for some years.
iii) Another drop in Lakes level will follow causing a second period of droughts about 2021± 2-3 years.
iv) One to three cyclic variations of lakes level will follow causing high outflow and ending by droughts conditions. Maximum level years are around 2014±2-3 yrs. and 2026±2-3yrs. (Yousef 1995a).The expected drought years are 2033± 2-3, or 2045± 2-3.
v) Climate change will occur by the end of weak solar cycles period. Herman and Goldberg (1985), list a number of reversals or failures of correlations between sunspot number and several meteorological parameters worldwide that happened in around 1913 and 1922.

It is worth mentioning that the sharp rise of lake Victoria in the 1960s was contemporary with similar rises in several African lakes. Lake Tanganyika level rose by 4 meters in 1964 over its level in 1960. Lake Rudolf level rose by 4 m. Lake Malawi's(previously called L. Nyasa) level was six-m higher in 1963 over its 1915 level. On the other hand, the Dead sea level dropped by few meters from 1957-63 (Mosa and references therein 1996). Countries concerned around those lakes are also warned of similar drought periods as those expected for lake Victoria.

It is worth mentioning that several other lakes showed solar forcing e.g Lake George in Australia (Hoyt and Schatten 1997 after Brooks 1923). It is also reported that Lake Zurich,, Lake Hamun-Sumpf in Persia and the Great Salt Lake have major maxima and minima concurrently with Lake George (cited in Hoyt and Schatten 1997 and references therein).

LAKE CHAD[1]

A- General Information

Right on the edge of the world's largest, driest desert-- the Sahara-- there lies a large freshwater lake. Lake Chad borders four countries in West Africa: Nigeria, Niger, Chad, and Cameroon. Lake Chad was once the sixth-largest lake in the world, but persistent drought since the 1960s shrank it to about a tenth its former size.

---

site"http://edcwww.cc.usgs.gov/earthshots/slow/laechad/lakechad

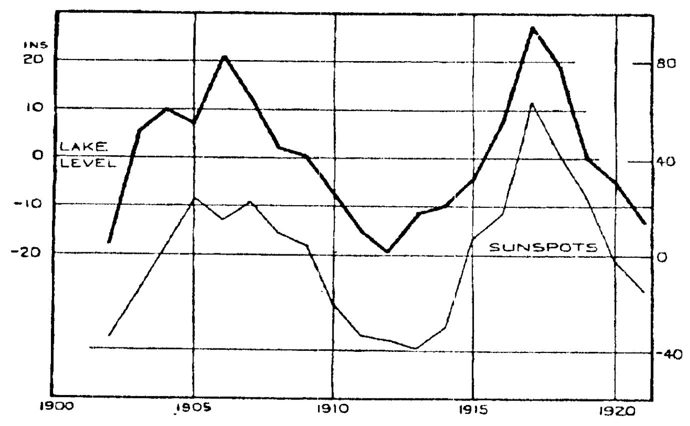


Fig 7: The cyclic rise and fall of Lake Victoria levels in response to solar forcing over two intermediate weak solar cycles (after Show 1933 cited in Burroughs 1994). The correlation coefficient is +0.88(cited in Herman and Goldberg 1985). Note that similar cyclic pattern of Lake Victoria level (from 1890 to 1902, with maximum at 1895) preceded the two cycles shown here. In other words, the Lake level sympathized with all of the weak solar cycles Nos 13,14 and 15. However, solar cycle No 12 which is the first of the intermediate weak series of cycles forced the Lake level to rise sharply in 1878-9 and then to fall between 1880 to 1890.

TABLE III Variation of Lake Victoria and Lake Nyasaland Levels In Response to Solar Forcing Arising From Wolf- Gleissberg Cycles

Wolf-Gleissberg cycles (after Table 1)	**Lake Victoria**	**Lake Nyasaland**
Cycle 2 Duration of Min 1797-1823		
Smoothed Max 1838-1840		1830 very low
Secondary Maximum 1860		1857 -63 very high
Cycle 3 Duration of Min 1877-1913	Sharp rise 1878 Drought 1902 Follow sunspot cycles closely 1890 -1922	1873 high, 75-8 falling annual variation about 3 feet,then follow sunspot cycles
Max (a) 1958	Sharp rise 1961	In 1963,6 m. higher than its 1915 level
Max (b) 1980	Rise ~1980	
Cycle 4 Duration of Min 1997-2032	Drop in level followed by sharp rise in 1997-98 Expected drought 2009±2-3 yr. Should then follow sunspot cycles. Drought 2021±2-3 & 2033 ±2-3 yr. ?	

THE PROSPECT OF EQUATORIAL AFRICAN LAKES

As is shown earlier, Lake Victoria and other African Plateau lakes showed response to solar forcing only at certain epochs . Keeping this in mind and forecasting solar cycles, it is thus possible to reflect past solar responses of the lakes into the forthcoming several decades.

Table III summarizes the response of Lake Victoria and Lake Nyasaland to Wolf-Gleissberg solar cycles. Lake Nyasaland, the third largest lake in Africa, also showed solar cycles sympathy in between Wolf-Gleissberg cycles (Dixey 1924).

The general remarks that can be deduced from Table III are as follows:

I) Major rises in Lakes levels occur at the maximum of the Wolf-Gleissberg cycle indicating climate change. In the case of a secondary maximum of those cycles the levels of lakes re-rise as in the 1980 case.

II) Another rise in Lakes level marks the end of the Wolf-Gleissberg cycle and the beginning of 12 year weak solar cycles. This will be followed by a decrease in Lakes level leading to drought period around the minimum of sunspot cycle.

III) The lakes level will then follow the weak 12-yr. sunspot cycles during the drop in between Wolf-Gleissberg as shown in figures 2 and 7.

IV) Such sympathy of lakes level to sunspot cycles disappears by the end of the weak 12-yr. cycle and the beginning of a new Wolf-Gleissberg with 11-yr. sunspot cycles. However at some locations, this sympathy might continue for one or two sunspot cycles. Climate change occurs at the border of the new Wolf-Gleissberg affecting various aspects of meteorological parameters worldwide.

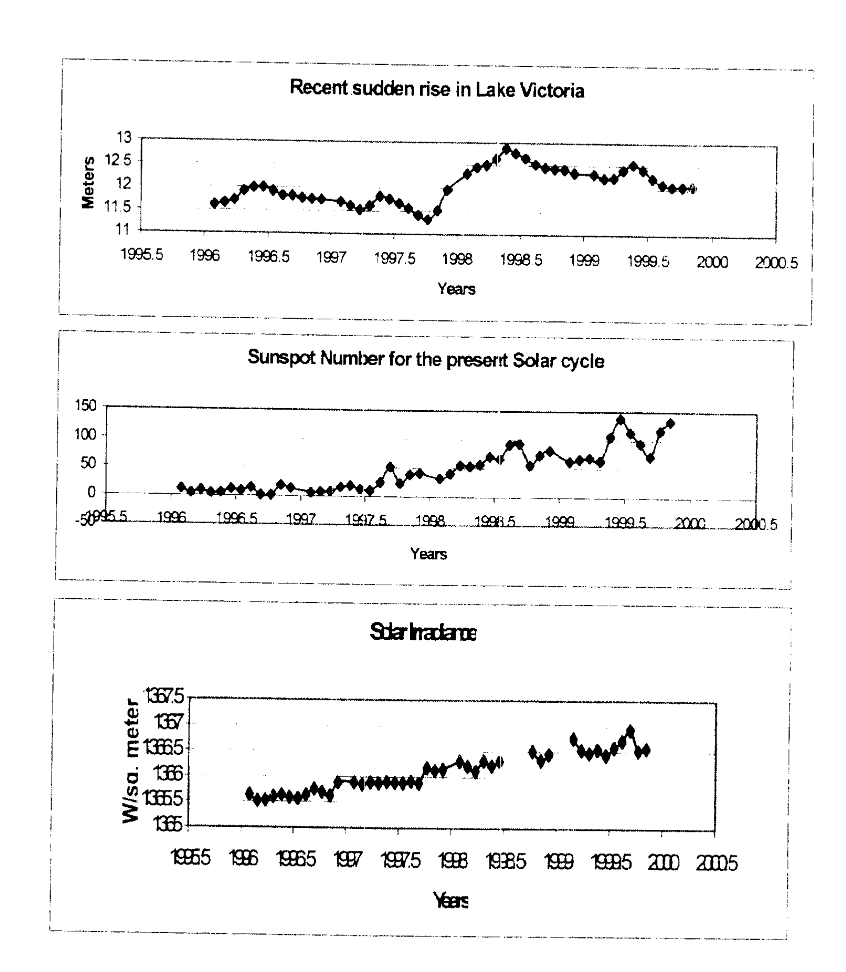


Fig 6: The 1997-98 sharp rise in Lake Victoria level, an indication to the end of previous Wolf-Gleissberg cycle and start of a weak 12 years solar cycle No 23. The present drop is expected to continue up till 2009.

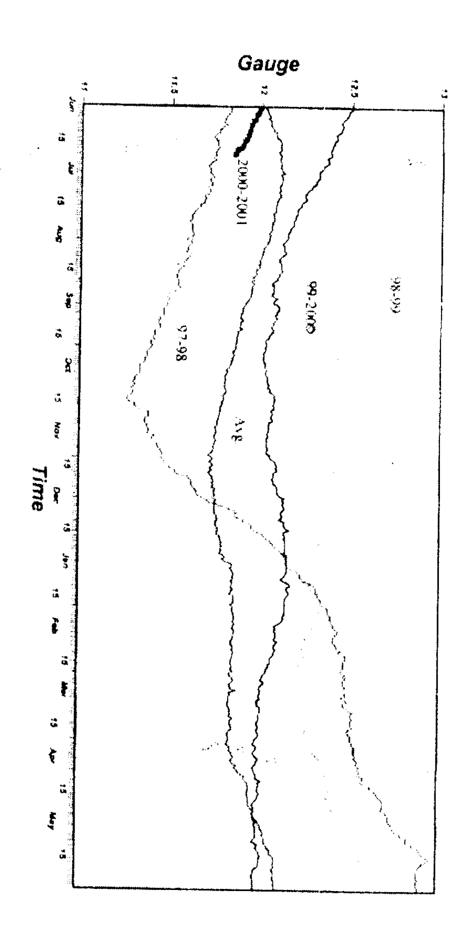


Fig 5: The 1997-98 sharp rise in Lake Victoria level at Jinja, an indication to the end of previous Wolf-Gleissberg cycle. Note the complete change of the annual pattern of gauge reading from the normal indicting climate fluctuation.. Figure courtesy

which seem to represent a recurrence of a regime that prevailed over long periods of years before the 1900-39 epoch of strong circulation , and were especially prevalent in the eighteenth and early nineteenth centuries and around 1880. The decline of temperate zone westerlies and increased frequency of blocking in high latitudes have been associated with anomalies (or changes) of temperature and rainfall regime that are having serious effects in many parts of the world.



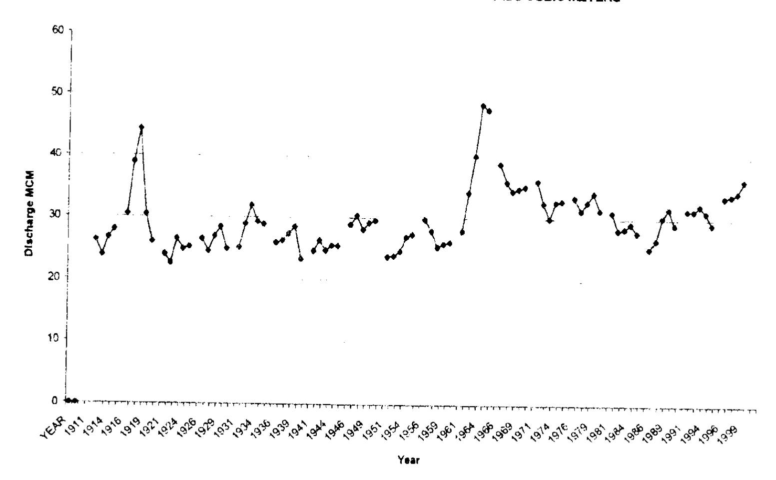


Fig 4

C-The 1997 Sharp Rise of Lake Victoria

Figure 5 shows the daily level of Lake Victoria at Jinja for the years 1997-2000 compared to the 1982-1999 average 1997 was a unique year as the lake level dropped steadily from June to October to 11.32 m then rose abruptly up to 12.87 m in May 1998. Around this time was the end of the previous solar cycle and the beginning of a new one. 1997-1988 was also a strong El Nino year.

Figure 6 shows the 1997-98 sudden rise in Lake Victoria in comparison with solar irradiance and sunspot number. Solar irradiance increase of about 0.11 in the above period is well associated with an increase of about 1.6 meters in the Lake level. The mechanism of this relationship is not currently well defined.

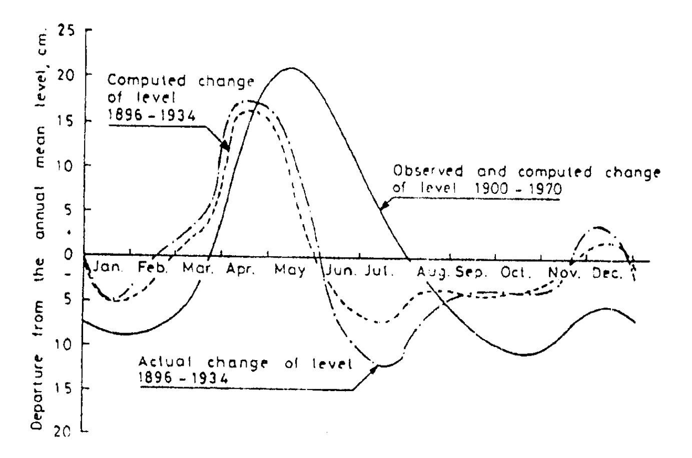
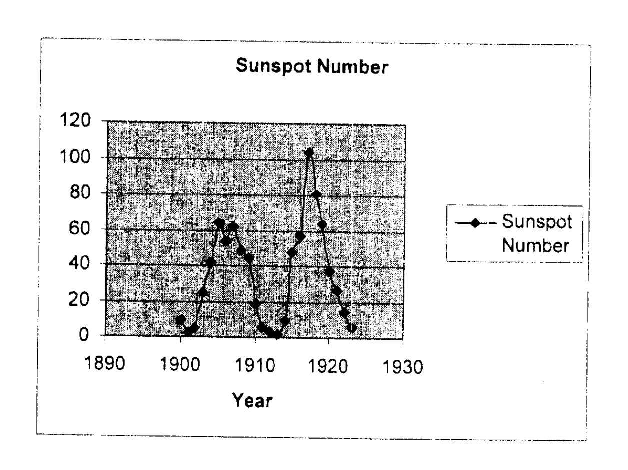


Fig 3: Seasonal oscillations of water level in Lake Victoria. The maximum change in level (1896-1934) was one month earlier than the (1900-1970),(after Shahin 1985).

The level of the water surface in Lake Victoria undergoes a seasonal variation. . The maximum occurs between April and May and the minimum occurs once in January- February and another time between July and October as shown in fig 3 (Shahin 1985). The increase in the amplitude of oscillation seems to have undergone a one month retardation in recent years. This phase shift in the seasonal oscillation indicates climate fluctuation during the period 1896-1934 due to solar forcing on precipitation collected in the Equatorial lakes. It is suggested that during the coming few decades, the amplitude of oscillation will be similar to the actual change of the 1896-1934 level with an April maximum and a narrower positive departure from annual mean level. , a pattern induced by weak intermediate 12 years solar cycles.

B-The 1961 Rise of Lake Victoria

Following the maximum of Wolf-Gleissberg cycle, another sharp rise of lake Victoria occurred. Lake Albert also showed such distinguished up rise. This again was an indication of a turning point in Wolf-Gleissberg cycle. This is also reflected at Malakal as seen in Fig 4. At the extreme left of the diagram, cyclic variation of discharge in response to the last solar cycle of the drop in between Solar-Wolf Gleissberg cycles is seen. According to Eddy's diagram for correlation between Lake Victoria's level (reproduced in Hoyt and Schatten 1997), the level became negatively correlated around 1950 with the sunspot cycle which is the maximum of the Wolf-Gleissberg cycle. In other words, the 1960s sudden variation of lakes levels either positive or negative indicated climate fluctuation due to solar forcing. According to Lamb (1966), such sudden changes as that around 1961, are rare and may imply the passing of some critical threshold value of something affecting the total energy of the circulation. The large scale circulation of the atmosphere during the 1960s has produced current that had never been seen in the 20th century before then, but



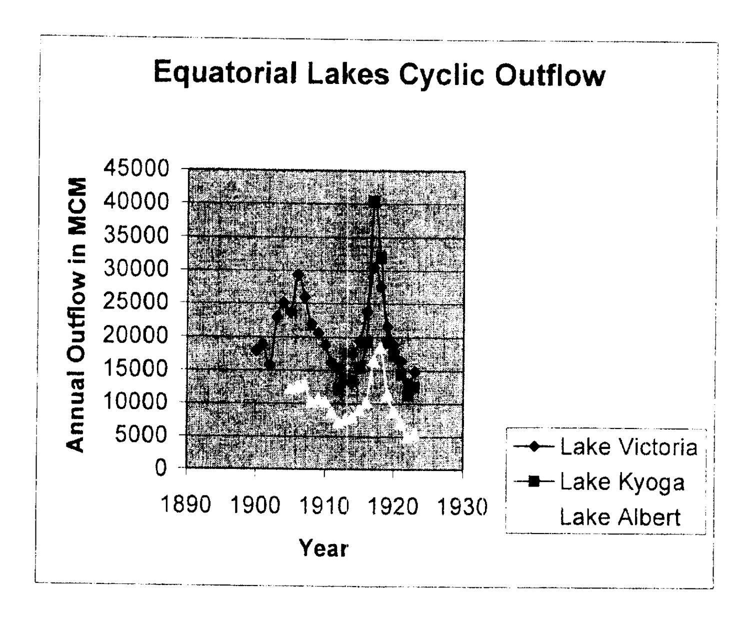


Fig 2: Variation of Equatorial Lakes outflow in milliard cubic meters (bottom curve) in response to positive solar forcing (top curve) during the period 1899-1923.

world wide. Several strong El Nino and La Nina events where in progress during that time.

Following this cycle, the Equatorial Lakes levels rose and dropped in sympathy with the following three solar cycles till 1922.

The following 10 year solar cycle was the first one of a series of a new Wolf-Gleissberg cycle characterized by high solar activity and this was the end of four weak solar cycles control of Equatorial Lake levels.

Table II Correlation Coefficients Between : Sunspot Number and Equatorial Lakes Outflow &Inter-correlation Between the Three Lakes For the Period of Solar Induced Forcing 1900-1922

	L.Victoria(1900-22)	**L. Albert(1905-22)**	**L. Kyoga(1912-22)**
Sunspot Number	0.85538	0.86888	0.90892
L. Victoria		0.90995	0.94764
L. Albert			0.93163

Table II shows very good correlation coefficients between sunspot number (during part of the the period of weak solar cycles in between two Wolf-Gleissberg cycles) and the Equatorial lakes outflow ranging from 0.86 for Lake Victoria and 0.91 for Lake Kyoga. Such strong correlation indicates solar control of the Equatorial lakes levels for the period under consideration. Eventually, the outflow of the three lakes are well correlated with each other. Maximum correlation of 0.95 exists between lake Victoria and Lake Kyoga Figure 2 illustrates the cyclic variations of equatorial plateau lakes outflow (lower curve) to solar forcing (upper curve).

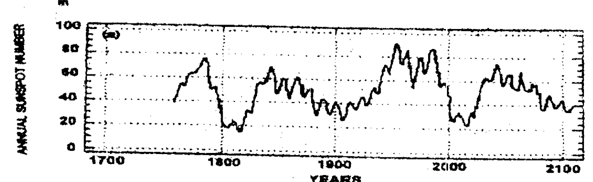


Fig 1(a) 18 years smoothed annual sunspot number showing observed and predicted Wolf-Gleissberg cycles.

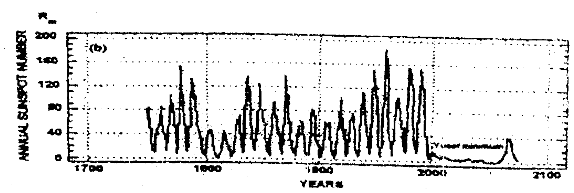


Fig 1(b): Observed and predicted annual sunspot number (1749-2080) showing the Yusof minimum

EQUATORIAL PLATEAU AFRICAN LAKES

A-The 1878 Rise Of Lake Victoria

The variation of the level of Lake Victoria can be summarized in the following fashion.

1- Rise in 1878 followed by continuos drop from 1880 to 1890, Garston (1903).
2- Continuos rise from 1892 to 1895 followed by continuos drop from 1896 to 1902, Garston (1903).
3- From 1902 to 1922 rise and fall of Lake Victoria level in close correlation with sunspot number for two solar cycles as shown in fig 2 (see also Shaw's 1933 diagram reproduced in Burroughs (1994).
4- Cut off of the relation between solar cycles and Equatorial lakes level afterwards.

The first rise was at a turning point in Wolf-Gleissberg cycle marking the end of active cycles and the beginning of a series of weak solar cycles of 12 years duration. 1877 was a Nino year that caused a low Nile flood, followed by 1878 destructive Nile flood which must have been caused by la Nina (Yousef 1995b, 1996). Contemporary drought-flood hazards occurred in teleconnected locations. This rise must have been sharp perhaps of the order of 2-2.5 m coincident with the start of the first weak 12 year solar cycle. The lake level did not rise in coherence with solar cycle, but rather a sharp rise occurred followed by a continuos decay. However, this rise was an indication of abrupt climate change to an era of low solar cycles manifested by flood- drought hazards

Eddy updated the Lake Victoria level and sunspot curves through 1972. More recently Yousef (2000), Yousef and Amer (2000) and Yousef et al.(2000) investigated this problem.

Solar forcing on African lakes prior 1922-24and the lack of correlation afterwards is the main task that will be addressed n the present paper. Once this dilemma is solved , then the results obtained can be reflected into the future.

THE WOLF-GLEISSBERG CYCLES

A long variation of roughly 80 yr., referred to asthe Wolf-Gleissberg cycle is detected in sunspot cycle amplitudes, as measured by the annual mean sunspot number,(Gleissberg 1958). Figure (1) illustrates such cycles and includes two possible projections into the future; either a coming drop of weak 12 years solar cycles or an inactivity period, the Yusof minimum which is similar to the Maunder minimum that prevailed in 1645-1715 AD (Yousef 1998).

Table I modified from Yousef (1995a) shows the characteristics of the last three Wolf-Gleissberg cycles as well as the coming one. It indicates that the maxima of the previous two cycles are double humped. The interval between the start of the minimum duration of the cycles 2 and 3 is 80 years. The duration between the start of minima of cycles 3 and 4 is 120 yr. and the interval between the two maxima of cycles 2 and 3 is 119 years, while the duration between the secondary maxima of cycles 2 and 3 is 121 years.

The existence of 121 year periodicity in Equatorial Nile water for the period (1129-1351 AD) as well as the 80 year periodicity found generally in Nile water (Yousef & El Rae 1995) indicates solar forcing on Nile sources.

Table 1 charesteristics of some recent solar-wolf-gleissberg cycles

Cycle	1	2	3	4
duration of min		1797-1823	1877-1913	1997-2032
smoothed min	1727-28	1810-1811	1901	2009
smoothed max	1779-1780	1838-1840	1957-1958	
secondary max		1860	1981	

the intermediate periods between Solar Wolf- Gleissberg-cycles, weak solar cycles occur which forces the lakes levels to show coherent rhythmic rises and falls. This intermediate period is a period of instability worldwide causing strong El Ninos, La Ninas and PDOs (decadal Pacific oscillations) in the Pacific ocean.

Earlier Equatorial African lakes sharp rises must have occurred at 1779,1838-40 as well as 1797 as anticipated from earlier Wolf-Gleissberg cycles marking earlier solar induced global climate changes.

As for El Sahel regime, rivers Senegal , Niger, Chari all show identical hydrological cycles as anticipated by Faure and Gac in 1981,with expected droughts at 2005 plus or minus few years. The Nile also show close resemblance with those rivers. As river Chari ends in Lake Chad, it is also anticipated that the level of Lake Chad will drop off for several years in the near future. It is anticipated that sharp rises of several meters in Lake chad level will follow the expected drought conditions.

It would have been of great value to include Lake Tana in this study, thus I am making an appeal to the Ethiopian authorities to provide me with the historical levels of Lake Tana which will be of value to Nile basin countries. Mean while, it is also anticipated that a drop of the level of Tana will happen shortly with drought conditions over blue Nile sources as anticipated from the resemblance of the Nile budget and the above mentioned rivers and God knows best.

INTRODUCTION

Indirect indicators of rainfall include water level in lakes and river flooding (Herman & Goldberg 1985). Rainfall is quite variable spatially. One place may have a intense downturn while a location only a few miles away has no rain at all. However lakes can be treated as large rain guages and their levels can be used to monitor rainfall (Hoyt& Schatten1997).

One classic example of sun/climate relationship concerns the level of lake Victoria. Hoyt and Schatten summarized such relationship after their references as follows "as early as 1901, E.G. Ravenstein pointed out that the level of Lake Nyasa (or Nyansa)in Africa parallels the level of solar activity. In 1923 C. E. P. Brooks made a classic study of Lake Victoria and Lake Victoria north of Lake Nyasa near the equator, Brook's study showed a very strong correlation between the levels of these two lakes and solar activity from 1896 through 1922. This 0.87 correlation implies strong solar forcing. Dixey in 1924 indicated that the 11 year cycle of Lake Nyasa's level extended from at least 1830 to 1923. G. T. Walker found that on the whole since 1923, the levels of the African lakes have not varied in accord with the sunspot numbers. The Upper Shire river which drained Lake Nyasa, gradually dried up , so by 1910 not even small craft could navigate it, and soon afterward the lake dried up completely.

1997-98 SOLAR INDUCED CLIMATE CHANGE AND ITS IMPLICATIONS ON DROUGHTS-FLOODS HAZARDS ON SOME AFRICAN LAKES DURING THE NEXT FEW DECADES

Shahinaz Mustafa Ali Yousef

Astronomy and Meteorology Dept, Faculty of Science -Cairo University

ABSTRACT

During few months in 1997-98, a 1.6 meter rise occurred in Lake Victoria level. Eventually other Equatorial African Lakes showed such abrupt rise in their levels with increased hydrological budget. Similar abrupt rise occurred in 1878 that was followed by a drop to drought conditions around 1900 and then systematic cyclic rises and falls of levels in sympathy with solar cycles occurred with correlation coefficient 0.86-0.91 up till 1922 when solar forcing influence apparently ceased to exist.

1878 and 1997 marked the ends of two Solar Wolf- Gleissberg-cycles of about 120 years duration. Following their termination, usually weak intermediate 12 years solar cycles exist. With the start of the first one of them, abrupt sudden rise of Equatorial lakes occur followed by a drop to several years of drought conditions around its minimum. The following few weak solar cycles induce solar forcing on the Equatorial African lakes and nearby lakes that cause cyclic variations in their levels with alternate droughts and floods situations. Since it is possible to forecast the level and years of minimums and maximums of the next few solar cycles, years of droughts and excessive floods over those locations can easily be forecasted for the next few decades.

On those bases alert is made to all Equatorial African countries to be ready for successive drought conditions around the years 2009±2-3yr., 2021± 2-3 yr. and 2032± 2-3 yr. Besides the 1997-98 , floods and good rainy years are forecasted around 2012-16 and 2024-28. It is advisable to exploit the good rainy years to increase crops and save them for the time of need both for human and animal consumption. It is also advisable to hurry up with digging the Jungly canal while there are good rainy years as its advantage will be greatly reduced at drought conditions.

Following the maximum of the last Solar Wolf- Gleissberg-cycle in the sixties, sudden sharp rises of several meters in Equatorial plateau lakes as well as Lake Rudolf which rose by 4 meters, Lake Malawi, Tanganyika and several others occurred causing extreme flooding in the area.

In other words, all Equatorial African lakes show abrupt rises in their levels at the turning points of the Wolf Gleissberg cycles with sharper rises following the maximums than at the termination points. Such rises are indicators of global solar induced climate changes. Other lakes or closed seas may show rises or falls at the Solar Wolf- Gleissberg-cycles turning points. At

الملخص

فوزية إبراهيم مرسي* ووفائي زكي عازر ميخائيل* وأحمد محمد كامل** وسلوى عادل بدرش **

* قسم الموارد الطبيعية- معهد البحوث والدراسات الأفريقية - جامعة القاهرة

** قسم بحوث العنب- معهد بحوث البساتين- مركز البحوث الزراعية

لهدف من إجراء هذا البحث هو التوصل لأفضل طريقة تربية تتناسب مع الظروف المناخية لمنطقة شمال أفريقيا حيث تعطى أعلى محصول وأجود صفات ثمرية. فقد اختير للتجربة منطقتين تبعد المسافة بينهما حوالي ٤٠ كم شمالا وذلك لأثبات أنه برغم تغير المناخ من منطقة إلى أخرى وبالتالي من عام إلى آخر ولو أن هذا التغير طفيف فلا يتعدى٥-٦ درجات مئوية إلا أن صفات الجودة ترجع لطريقة التربية والمناخ الدقيق الذي تخلقه الشجرة بداخلها فيكون هو المؤثر الوحيد الذي يتحكم في أفضلية طريقة عن أخرى..

المنطقتان موضع الدراسة هما الخطاطبة ومدينة السادات ، على طريقتي التربية أو التدعيم "T " وطريقة "Y " لصنف عنب "طومسون سيدلس " والكرمات متفرعة على مسافات ١٫٢٥* ٣٫٠٥ م وتم معاملتين باختيار أفرع في الظل وأخرى معرضة بالكامل للضوء وتم اخذ قراءات الأرصاد الجوية بجهاز خاص وذلك عن طريق توجيهه إلى النباتات على ثلاث مستويات هي: أعلى و أوسط وأسفل النبات حتى تكون القراءة ممثلة للشجرة ككل وسجلت هذه القراءات خلال موسم النمو وذلك في الفترة من نصف ديسمبر ١٩٩٨ وحتى الجمع في أواخر يونيو١٩٩٩ . وقد استخدمت الطرق الإحصائية المتقدمة متعددة المتغيرات: التحليل التوافق و التقسيم الهيراركى كما استخدمت الطرق الإحصائية العادية.

? بصفة عامة ظهرت القياسات و التحليلات الكيميائية التي تم دراستها تفوق طريقة التربية (التدعيم) "T" عن طريقة التربية " Y " و تبين ذلك في كلا من المزرعتين الواقعين تحت ظروف مناخية مختلفة.

سجلت متوسطات درجات الحرارة ارتفاعا في النباتات المرباة بطريقة التربية " Y " عن المرباة بالطريقة " T " وذلك لأنها تعمل على فتح قلب الشجرة وبالتالي تكون كمية الضوء الساقط على النبات أعلى فيها عن طريقة "T ". وبما أن الأبحاث أثبتت أن الارتفاع في درجة الحرارة عن الحد اللازم يؤدى إلى الإسراع بنضج العناقيد قبل اكتمال نموها مما أدى إلى أفضلية قياسات الطريقة "T " حيث أن شكل الأفرع المرباة عليها تعمل على تقارب الأوراق مما يؤدى إلى قلة كمية الضوء الساقط وبالتالي قلة درجة الحرارة و زيادة الرطوبة النسبية داخل وحول النبات مما أدى لتحسين صفات وجودة المحصول في طريقة "T " عنها في طريقة " Y " برغم اختلاف درجات الحرارة من منطقة إلى أخرى و من عام إلى آخر، وهذا يرجع إلى المناخية الدقيقة التي تخلقها الشجرة بداخلها والتي هي في الأصل راجعة إلى المناخ الجوى العام بالمنطقة، تكون أكثر مناسبة للظروف المناخية لمنطقة شمال أفريقيا، حيث أن العنب واسع الانتشار.

REFERENCES

Allweldt, G (1963) Emfiub von klimafaktoren auf die z:ehlder infloreszenzen bei rebea (influence of climatic factors on the number of inflorescences in grapes). Wein-Wissensehafi 18, 61-71.

A.O.A.C. (1980) Official Methods of Analysis. Association `of Official Analytical Chemists. Washington, DC: 793 pp.

Baldwin, J. G., (1964) The relation between weather and fruitfulness of the Sultana vine. Australian Journal ofAgriculture 15: 902 908.

Cartechini, A. and Palliotti, A. (1995) Effect of shading on vine morphology and productivity and leaf gas exchange characteristics in grapevines in the field .A,n. j Enol. Vitic. 46 (2): 227-234.

Dokoozlian, N. K. and J(liewer, W. M. (1995)The light environment within grapevine canopies. II. Influence of leaf area density on fruit zone light environment and some canopy assessment parameters American Journal of Enology and Viticulture 46(2): 219-226.

Francot, P. and Mauro, J. (1948)Action des phytahormones sur la vigne . Bull, L'Of V' 214, 32 45, Greenacre,M. J. (1984)

Theory and Application of Correspondence Analysis, London, Academic Press: 364 pp

Hunter, J. (1998)Plant spacing implications for grafted grapevine. II. Soil water, plant water relations, canopy physiology, vegetative and reproductive characteristics, grape composition, wine quality and labour requirements. South Africa Journal for Enology and viticulture 19(2): 35 51.

Hunter, J. J.; Volsehenk C. G.; Fouche, G. W.; Roux, D. J. and Burger, E. (1997) Performance of Vitis Vinifera L. CV. Pinot Noir/99 Richter as affected by plant spacing In: Proceedings of the Fourth International Symposium on Cool Climate Viticulture andEnology, Rochester, New York, USA, 16-20 July 1997:1-40 - I-50.

Igounet, 0.; Baldy, C.; Robin, J. P.; Botilet, J. C.; Sanon, M. and Suard, B. (1995) Effects of artificial soil covers on the internal temperatures of bunches of grapes during ripening. International des Sciences de la Vigneetdu Vin29(3): 131-142.

Kamel,A.(1984) Studies on bud development in Thompson Seedless grapevine. Agric.Res. Rev. 62:18-25. May, P. (1964)

Uber dicknospen-und infloreszentwicklung der rebe (Sur le developpement des bourgeons et der inflorescences de la vigne. Tradoit: M. Rives). Wein-Wissenscheft Johrgang 1964, seitc 457-485.

Reuther, G. and Metzner, H (1983)The effect of water stress on photosynthesis and transpiration of Vitis Vinifera under different ecological conditions. Photosynthesis and plant productivity 1983: 78-82

Roux, M. (1985)Algorithmes de Classification, Paris, Masson: 151 pp.

Roux, M. (1987) DATDVISION I .2 logeciel d' analyse de donnees, Montpellier, CEPE/CNRS: 30 pp.

Simth, F.; Gilles, M. A.; Hamilton, J.k. and Gedess, P.A. (1956) Colorimetrical methods for determination of sugar and related substan; AnaA Chei'i. 28,350.

Wettstein, D.V. (1957) Chiorophyil-letale und der submikro skopische lorrnwechsei der plastids; Experimental cell Research, 12: 427.

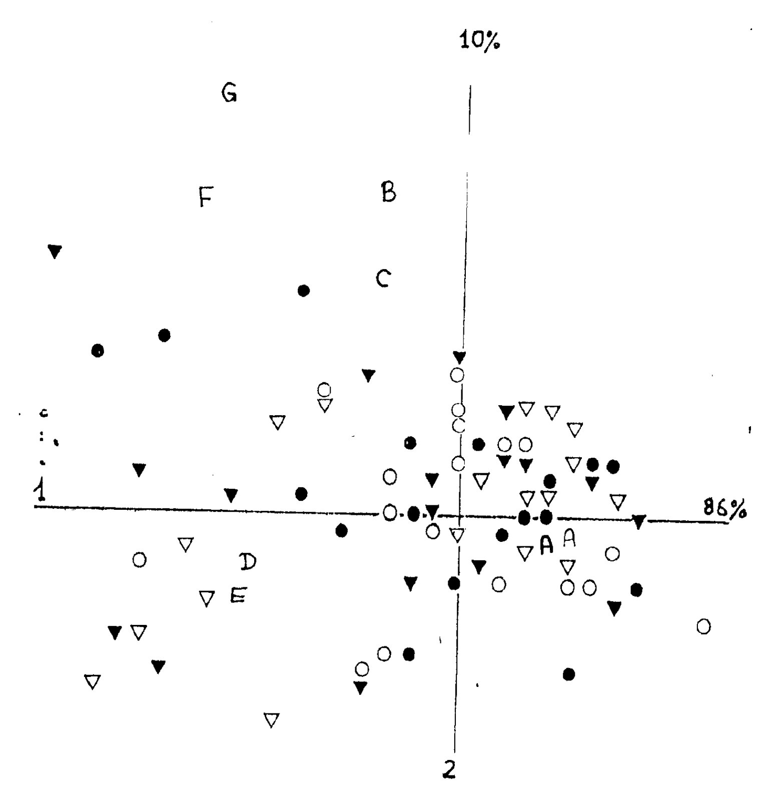


Fig. (2) Graphical representation of the application of CA and AHC methods to data of bunch weight (A), bunch width (B), bunch length (C), weight of 50 berries (E), acidity (F), total soluble solids (G), Gircles are for "T" training system, triangles are for "Y" training system, open circlos and triangles are for sun exposed parts and closed circles and triangles are for shaded parts

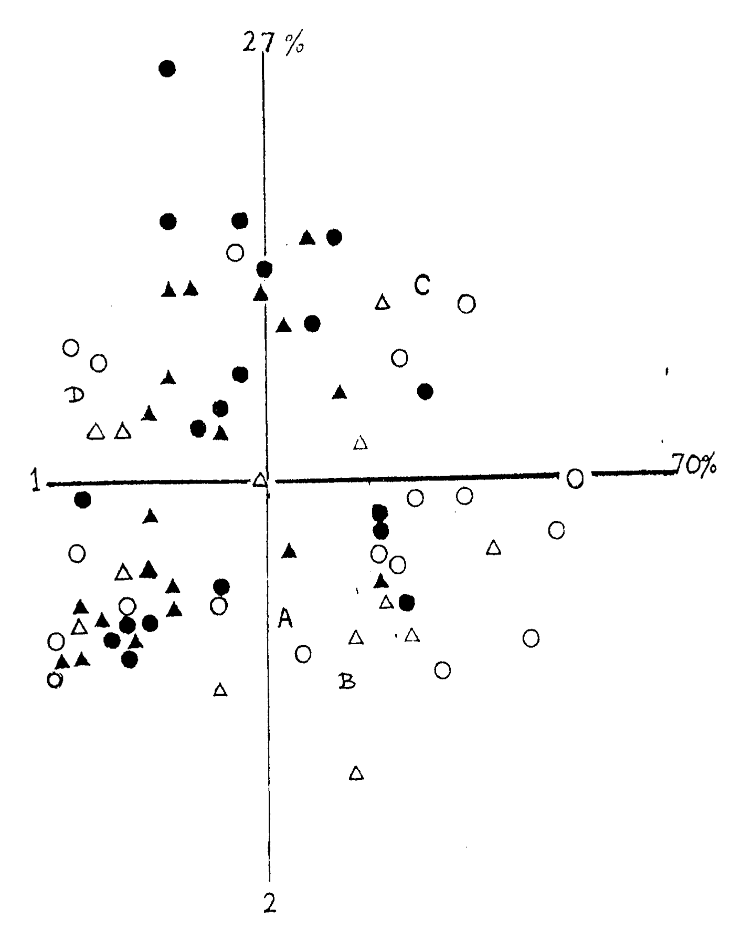


Fig. (1) Graphical representation of the application of CA and AHC methods mieroclimate data : air temperature (A), crop temperature (B), relative humidity (C), light intensity, Circles are for "T" training system, triangles are for "Y" training system, open circles and triangles are for sun exposed parts and closed circles and triangles are for shaded parts.

Table (2) Averages of the physical and chemical characteristics of Thompson Seedless grape in the two farms.

Farm	First				Second			
Training System	T		Y		T		Y	
Light Intensity	Sun	Shade	Sun	Shade	Sun	Shade	Sun	Shade
Bunch weight (gm)	579	549	413	401	366	353	362	333
Bunch width (cm)	16.7	15.8	14.9	13.7	14.0	13.8	13.3	13.0
Bunch len4h (cm)	27.1	24.4	22.6	21.4	25.5	24.7	22.7	22.4
Weight of 50 berries (gm)	106	104	104	100	87	84	72	69
Volume of 50 berries (cm^3)	93	92	89	87	73	71	61	60
TotalSolubleSolids (TSS%)	153	13,8	17.6	17.2	15.0	14.2	18.6	17.2
Acidity %	0.88	1.08	0.85	1.00	0.88	1.12	0.81	1.11
TSS%/acidity	17.9	20.6	18.4	20.2	12.2	13.0	16.9	20.6
C arbohvdrates %	25.9	22.5	24.8	22.1	27.1	21.6	27.3	18.9
Leaf Content of Pigments								
Chlorophyll A	0.54		0.55		0.44		0.47.	
Chlorophyll B	0.19		0.21		0.13		0.19	
Carotene	0.39		0.38		0.31		0.32	
Nitrogen Content %	2.24		2.14		2.66		2.53	
Leaf area (cm^2)	122.6		114.5		112.8		110.1	

Table (1) Averages of the microclimatic measurements in the two farms,

Farm	First		Second	
Training system	**T**	**Y**	T	Y
I Air temperature ^{0}C				
Lower part	28.4	30.3	30.0	31.6
Middle part	28.0	29.1	29.6	30.8
Upper part	28.3	29.4	28.9	30.3
Crop temperature ^{0}C				
Lower part	25.4	29.6	28.3	31.3
Middle part	23.6	26.1	26.9	29.1
Upper part	24.8	25.8	26.4	28.1
Relative Humidity %				
Lower part	39.2	37.1	30.8	31.3
Middle part	38.2	35.7	31.2	31.1
Upper part	37.9	35.0	31.0	29.9
Light intensity (Watt/m2)				
Lower part	51.1	54.2	38.3	38.2
Middle part	54.4	57.8	47.4	48.7
Upper part	71.6	73.4	73.9	74.8

middle of July had an effect on the number of clusters per shoot in the following year (Allweldt, 1963).

Exposure to the high temperature resulted in smaller berries than exposure to either the intermediate or low temperature. Igounet et al. (1995) studied the effects of artificial soil covers on the internal temperature of bunches of grapes during ripening. They found that the difference between the internal temperature of the bunches and the air temperature was particularly high and affect sugar content. They also mentioned that statistical analysis of meteorological data showed that, solar radiation, wind speed and air temperature were the main factors affecting grape bunch temperature. From the results of the present investigation, we could see that crop temperature and relative humidity are important factors as well as those mentioned by Ignouet ef al. (I 995).

Igounet et al, (1995) studied the effects of artificial soil covers on the internal temperatures of bunches of grapes during ripening period. They found that the difference between the internal temperature of the bunches and the air temperature was particularly high and affect sugar content. They also mentioned that statistical analysis of meteorological data show that solar radiation wind speed and air temperature were the main factors affecting grape bunches temperature.

The above mentioned results are in agreement with the results of the present work where micro climatic data include air temperature and crop temperature. Crop temperatures of vines trained in the "Y" system has higher temperatures than those trained in the "T" system' This difference led to accelerate the ripening of bunches in the "Y" system before completing their growth. Thus we can explain why bunches are higher in their physical characteristics in the "T" system than that in the "Y" system.

The previous results of the study proved that the percentage of budburst and bud fertility of "T" training system is higher than that of "Y" training system, thus indicating that the vines of the former are more productive than the later. Not only "T" training system is more productive than "Y" training system in both the physiological and chemical characteristics.

Hence, we can conclude that "T" training system is more adaptable and favourable for grape production in the new regions of grape plantation in Egypt in the desert and the new reclaimed land as well as in similar environmental and climatological conditions of Morrocco and other countries of North Africa.

effect on bunch weight, weight and volume of 50 berries, since their points are nearly at the middle of the ordination graph near the horizontal axis.

One can conclude that the training systems have more effect on the above mentioned characteristics rather than light intensity.

Bunch length and width, total soluble solids (TSS%) and acidity are being affected by light intensity rather tlian training system. Bunch length and width are greater in the sun-exposed parts than that in the shaded ones. The same phenomena is applied to each of TSS% and acidity. These two chemical characteristics of berry juice are strongly affected by lightintensity and being better when they are sunny than they are shaded.

DISCUSSION

Shading causes the decreasing of the leaf dry weight, leaf soluble carbohydrates, leaf starch content, vine yield, total soluble solids in the berries, total leaf per vine, number of auxiliary shoots per cane, and winter pruning. The weight of the vine yield and the quantity of berry decreased linearly with the increasing of shade intensity (Cartechini and Palliotti 1995).

Light intensity and air flow within the canopies of closely spaced vines is low. Closely spaced vine canopies had lower photosynthetic activity, which was accompanied by increasing transpiration, Canopy shade patterns of the different plant spacing during the growing period showed that the continuous shading of soil in narrow spacing could have prevented excessive evapotranspiration.

Generally shoot, leaf and berry growth rates are increase under narrower spacing, whereas total leaf area/vine decreased (Hunter et al. 1997). Improved bunch exposure to sun light can alter grape berry thermal relations, sugar and acid compositions of abundant shade like those found in a dense canopy which result in lower berry weight, cluster initiation, fruit set, cane hardness and higher pH levels in the berries. The fruits which well exposed to sun light generally gain higher concentration of sugars if it is compared with the fruits ripened in dense canopy and consequently have bad exposed to the sun light (Dokoozlian and kliewer (1995)

Reuther and Metzner (1983) studied the effect of the water stress on photosynthesis and transpiration of Vitis venefera under different ecological conditions. They found that photosynthesis of the young plants was reduced by both soil moisture stress (30%-70% of capacity) and atmospheric moisture stress (30%-50% or 70%). They also found that the early June), which included the time of vegetative bud change into the flowering primordia (Baldwin, 1964). Kamel (1984) found that it occurred at 1st of May.

On the other hand, unfavorable weather conditions during the formation of the cluster primordia in June caused poor fruitfulness in the following year, particularly on the basal buds of the fruit spur (Francot and Mauro, 1948). Furthermore, the temperature from the middle of June to the

length and width, weight and volume of 50 berries, total soluble solids (TSS%) and acidity (Table 2), were subjected to the recent multivariate statistical methods: correspondence analysis (CA) and ascending hierarchic classification (AHC).

Fig (1) shows the results of the application of ordination techniques CA and AHC, with respect to microclimatic measurements (Table 1). Seventy percent of the total variance is associated with the first (horizontal) axis and 27% with the second (vertical) axis. The first axis separates the "T" training system at the right hand side of the ordination graph and the "Y" training system at the left one. The vertical axis separates the light intensity into the sunny parts at the bottom and the shaded ones at the top of the ordination graph.

Air and crop temperatures are highei in the sun-exposed parts than that of shaded ones but in contrarily relative humidity is higher in the shaded parts than that in the sun-exposed parts. Generally Values of RH% are higher in "T" than that in "Y" training system.

Light intensity has higher values in "Y" than that in "T", since the "Y" is more opened and all vine parts are sun-exposed, whereas "T" is closely trained canopy and most of the vine pai4s are shaded. However air and crop temperatures are slightly higher in "T" than that in "Y".

The total variance associated with the analysis of physical and chemical characteristics of the vine is 96%. On the other hand, the total variance associated with the analysis of microclimatic data is 97%. In the case of the physical and chemical characteristics of the vine, the attributes used are quietly enough to illustrate the behaviour of the vines under different training systems and different treatments.

For the microclimatic data it is clear that the measurements, which are taken during the period of the present investigation, are the most important climatic factors that affect vine growing and its physical and chemical characteristics.

Fig (2) shows the results of the application of these techniques on the data of Table (2). Eighty-six pdrcent is associated with the first (horizontal) axis and 10% with the second (vertical) one. The first axis separates between the two training systems adopted in the present investigation. The "T" is at the right hand side of the ordination graph while the second axis separates between sun light and shade treatment. The sun light is being at the two parts while shade is at the bottom of the ordination graph.

The application of ordination techniques showed better understanding of such training on the physical and chemical characteristics of the vines.

Bunch weight is larger in the "T" training system than that in "Y" one. On the other hand, weight and volume of 50 berries are being the same in the two training systems. The light intensity, both sun and shade, have no direct

RESULTS

Table (1) shows results of the average microclimatic measurements, air and crop temperature in 0C, air relative humidity % and light intensity as Watt/m^2.

Microclimatic measurements show that vines trained by "Y" shape were recorded an elevation in the air temperature than those trained by "T". This elevation is due to the fact that, the "Y" training system is more opened trained canes, which permit to much more falling sunlight allover the vines, since this elevation in the air temperature over than the normal limits, lead to the rapidity of bunches ripening before reaching their optimum maturity. This causes the pre-eminence of measurement in "T" training system on those of"Y", where the canes are closely trained, which led to the rapprochement of leaves, those do not permit to a large amount of sunlight to penetrate through leaves and reaches the bunches and these create a low temperature inside the vine canopies.

These conditions cause the rising of relative humidity, which also influence the development, by reducing the effects of temperature, but no data show that it has a direct effect on the balance of composition of the fruit at maturity. It stills the only factor of climate that proved to be of predominant importance is temperature.

The microclimatic conditions prevailing during the period March-May are more favourable for the bunch development of the current year and flower bud formation of the following year in "T" system than in "Y" system. This enhances higher production in "T" than in "Y" in the two successive seasons.

Table (2) shows results of the physical and chemical characterstics of Thompson Seedless grape vine of the present study. Generally we noticed that the sun-exposed parts of plant, leaves, bunches and shoots showed best results of grape characteristics than those in the shade regardless to the training system . The average weight of sun-exposed bunches was higher in the "T" training system (466 gm) than that in "Y" training system (382 gm), whereas in the shaded bunches was (456 gm) in "T" and (373 gm) in "Y" training system. The average length and width of sun-exposed bunches in "T" were 26.2 and 15.3 cm, and in "Y" training system were 22.6 and 13.3 cm, respectively. The shaded bunches were in T" 24.5 and 14.7 cm and 21.9 and 14.1 cm in Y", respectively. All the chemical and physical characteristics of bunches, 'leaves and shoots showed the predominance of sun-exposed parts of vin'es than the shaded parts. Light intensity under study did not appear any obvious effect on the leaf area. Generally, we can conclude from the present work the comparing between the two training systems, regardless the effect of light intensity that, "T" training system showed better results in the physical and chemical characteristics of plant than" Y"

In order to clarify the mean differences and interactions of training systems and the microclimatic measurements, air and crop temperature, RH, and light intensity (Table 1) on the grape attributes (bunch weight, bunch

(A.O.A.C. 1980), leaf area (cm2 using laser area meter CI - 203 instrument), Shoot content of carbohydrates as gm glucose /100 gm dry weight (colorimetrically at 490 mu wave length, Smith et al. 1956), nitrogen content (A.O.A.C. 1980) and the leaf contents of pigments, Chlorophyll a and b, and Carotene as mg/gm fresh weight of leaves (A.O.A.C. 1980). The concentrations of chlorophyll kinds were calculated as described by Wettestein (1957).

Microclimatic data

Measurements of microclimate such as air temperature, canopy temperature, relative humidity and light intensity were recorded weekly during the growing period from the beg'inning of bud bursting on the first week of March to the haiwesting at the end of June on the two training systems in the two selected farms.

The first concerning is the measurements of microclimatic factors in which are taken on the three layers of the grapevine:

1. The lower layer (zone between soil surface and lower parts of the vine canopy which represent zone of reflected heat from the soil surface).
2. The middle layer (most of bunches are present).
3. The upper layer (zone of canopy top).

The second direction is concerning the by physical and chemical characteristics of the vine. Since the yield is presented in both shaded and direct sun-exposed parts of the vine samples were taken as an indicator about the degree of quality in both parts.

They were measured using "Scheduler Plant Stress Monitor", Standard Oil Engineered Materials Co., Ohio, USA (Plate 1). All the above- mentioned measurements were used by the microprocessor of the apparatus to calculate the average of canopy microclimate in order to find the relationship between the microclimate and the type of trellis.

Statistical treatment

Data of the microclimatic measurements and the physical and chemical characteristics were treated b'y multivariate statistical methods: correspondence analysis CA (Greenacre 1984) and ascending hierarchic classification AHC (Roux 1985). The computer calculations for CA and AHC were carried out at Cairo University using DATAVISION programme 1.2 (Roux, 1987) developed for APPLE IIe in BASIC.

As a result, each training system creates special microclimate insideits vine canopy. These differences in microclimatic condition affect the grape quality and productivity.

Most vinifera grapes require long, warm - to - hot, dry summers and cool winters for best development. They are not adapted to humid summers because they are susceptible to certain fungus diseases that flourish under such conditions. For proper vine development and maturity, most varieties require daily mean temperature of at least (180 C). Thompson Seedless will be mature for table uses (180 Brix). Temperature especially during the ripening period greatly influences the sugar and /or acid content of grapes and also affects their qualities for various uses.

The present study aimed to investigate the relationship between the type of training system with its microclimatic conditions on one hand, and with grape quality and productivity on the other hand, in order to evaluate these two types of training systems.

MATERIAL AND METHODS

The Study Areas

This work was carried out in two vineyards, Katatba and Sadat City locations during the period from December 1998 till the end of the growing season in October 1999. Katatba and Sadat locations are lies about 82 km and 124 km to the north, along Cairo Alexandria desert road, respectively, The distance between the two vineyards was about 42 km. These two vineyards are cultivated with grape cultivar Thompson seedless (Vitis viriefera L.). Soil in these two areas is irrigated by the method of dripping in which the irrigation is suitable to the sandy soil that needs a great amount of water. Two treatments of training systems are investigated in each farm, the telephone "T" and the "Y" training systems.

Khataba area has minimum temperature of 13.8 0C while the maximum is 28.0 0C with mean temperature of 20.8 0C. Air relative humidity is 61% and the total rainfall is 38.1 mm/yr. Sadat City area has minimum temperature of 14.3 0C while the maximum is 28.8 0C with mean temperature of21.0 0C. Air relative humidity is 54% and the total rainfall is 41.4 mm/yr.

Sampling Methods

Eighteen vines, divided in 3 rows (6 vines each) represented each treatment. Samples of leaves, shoots and bunches were taken from the sun exposed part and the shaded part for physical and chemical determinations. Three replicates were taken. These vines were marked for regular investigations at weekly intervals.

The physical chemical characteristics as bunch weight (gm), bunch dimensions (length and width in cm), weight (gm) and volume (cm3) of fifty berries, total soluble solids (TSS%, using hand refractometei'), acidity

EFFECT OF MICROCLIMATE ON THE VEGETATIVE AND REPRODUCTIVE GROWTH OF GRAPES CULTIVATED IN EGYPT AND MOROCCO

Fawzia I. Moursy*, Wafai Z. A. Mikhail*, Ahmed M. Kamel** and Salwa A. Bedresh* *

*Department of Natural Resources, Institute of African Research & Studies, Cairo University, Giza, Egypt

**Viticulture Department, Horticulture Research Institute, Agricultural Research Center, Giza, Egypt

ABSTRACT

The work was carried out in two vineyards, Katatba and Sadat city, The first lies about 82 km and the second lies about 124 km to the north, along Cairo-Alexandria desert road. The distance between the two vineyards was about 42 km. These two vineyards were cultivated with grape cultivar Thompson seedless (Vitis vinefera L.). Two treatments of training Systems were investigated in each farm, the telephone "T" and the "Y" training systems.Samples and microclimate data were taken from three layers of the vine canopy, the upper layer which exposed directly to sun rays and the middle layer which protected partly from sun rays by the upper layer and the lower parts above the soil surface. Data were statistically treated by routine statistical methods as well as the advanced methods, i. e. correspondence analysis and ascending hierarchic classification. Results show that "T" training system showed better results in the physical and chemical characteristics of plant than " Y ". This is due to that, the "Y" training system is horizontally trained canes, which permit to much more falling sunlight allover the vines, since this elevation in the air temperature over than the normal limits, lead to the rapidity of bunches ripening before reaching their optimum maturity. This causes the pre-eminence of measurement in "T" training system on those of"Y", where the canes are vertically trained, which led to the rapprochement of leaves, those do not permit to a large amount of sunlight to penetrate through leaves and reaches the bunches and these create a low temperature inside the vine canopies. These conditions cause the rising of relative humidity, which also influence the development, by reducing the effects of temperature, but no data show that it has a direct effect oh the balance of composition of the fruit at maturity. It still the only factor of climate that proved to be of predominant importance is temperature.

INTRODUCTION

Grapes trained all over the world by many methods according to the climatic conditions of each country. In Egypt two newly introduced training systems were used in most vineyards. The first methods is the Telephone "T", in which the new shoots of the vine are vertically shaped. The second method is known as "Y' training system, in which the new shoots of the vine are more opened.

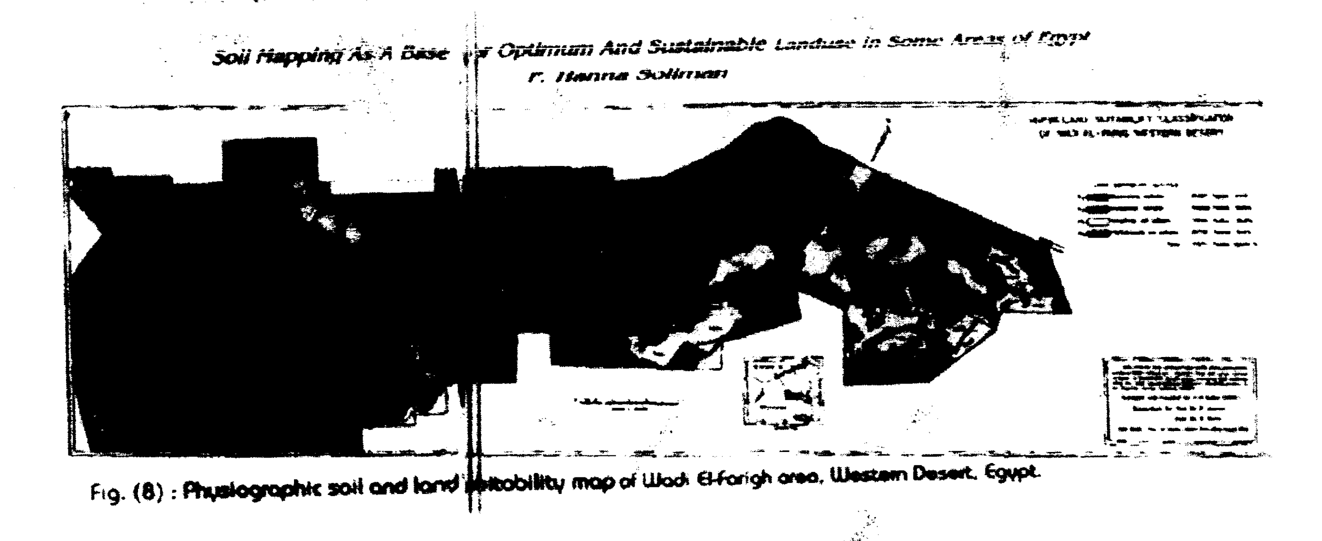
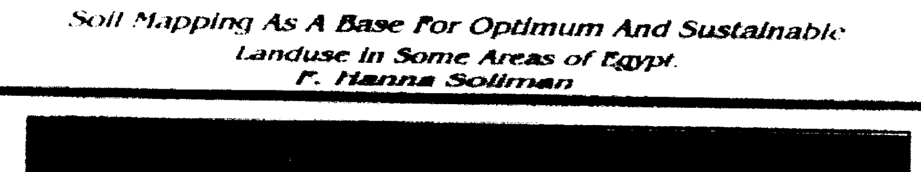


Fig. (8) : Physiographic soil and land [su]itability map of Wadi El-Farigh area, Western Desert, Egypt.



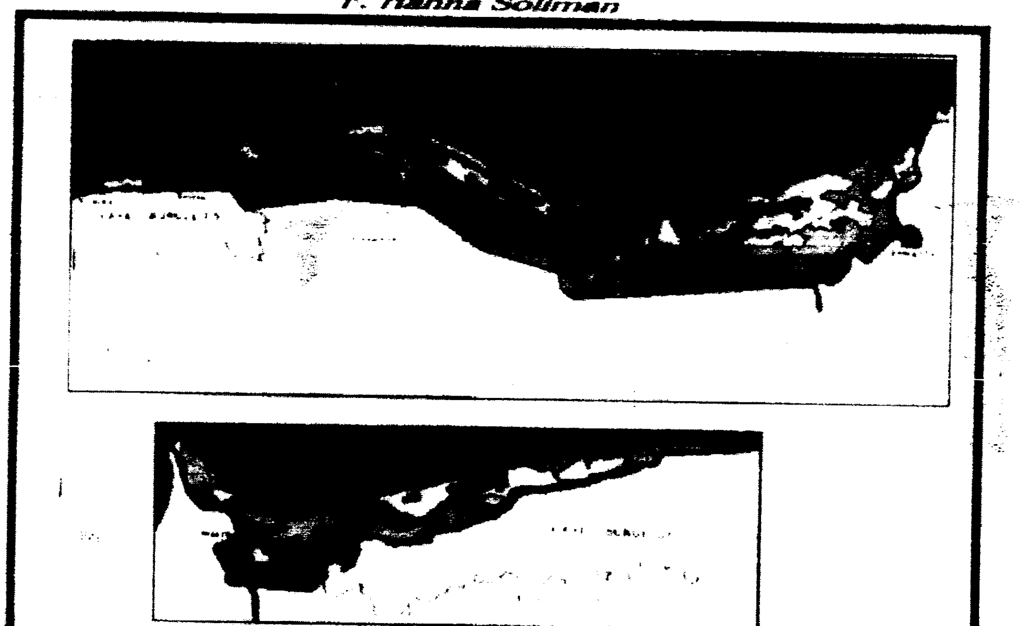


Fig. (5): Physiography and soil map of the coastal zone Nile Delta Egypt.

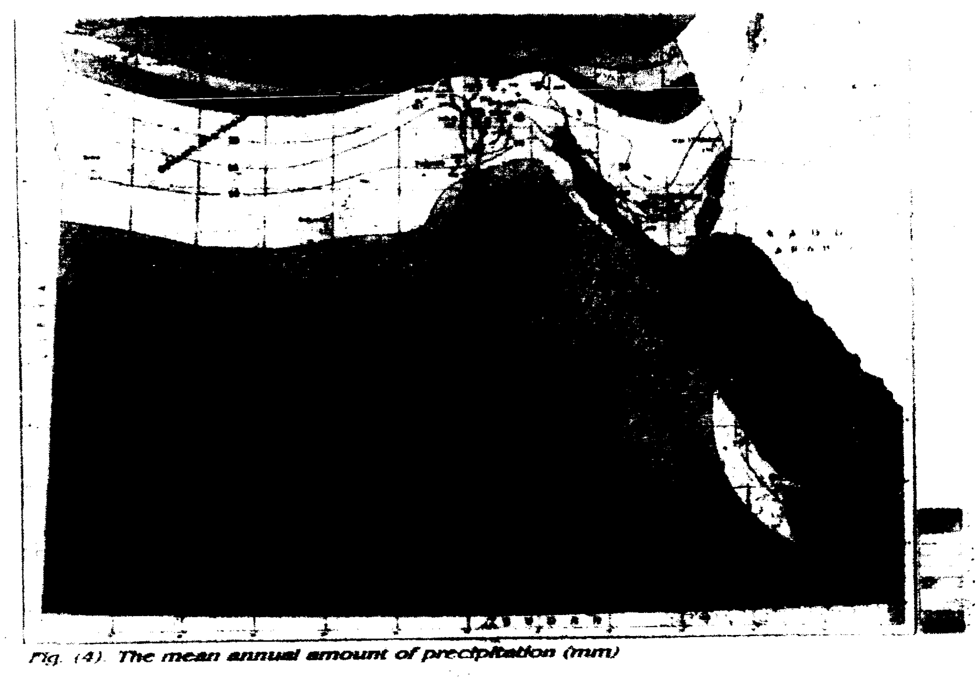


Fig. (4). The mean annual amount of precipitation (mm)

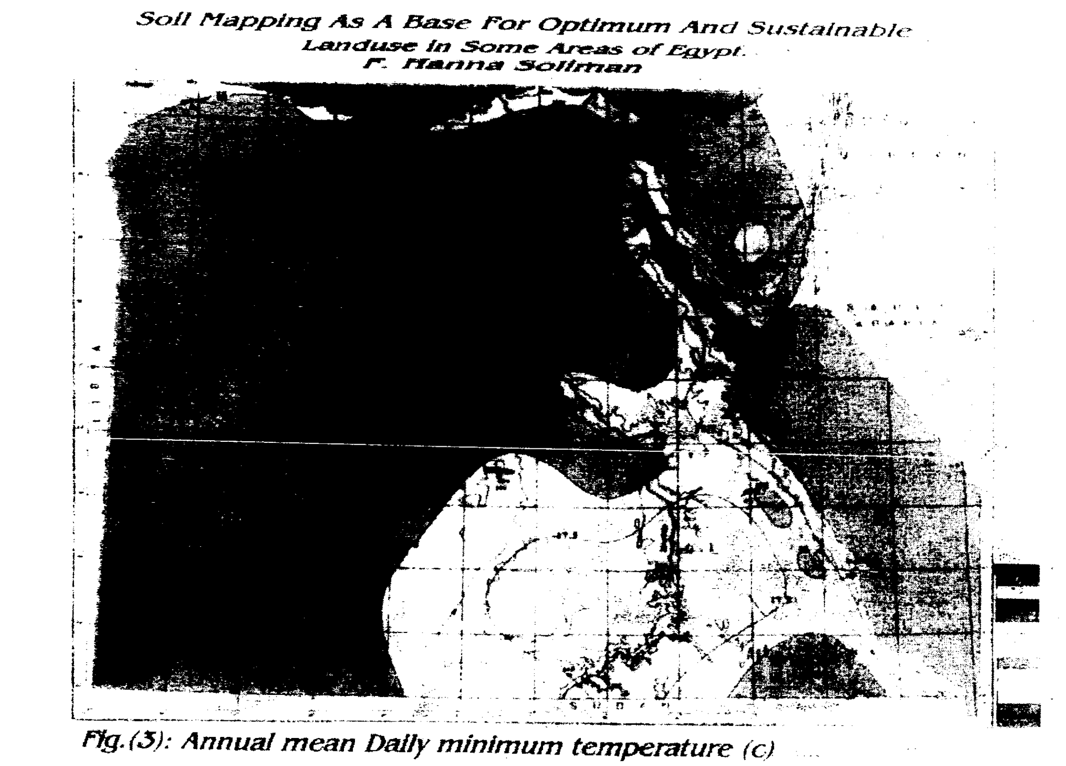


Fig.(3): Annual mean Daily minimum temperature (c)

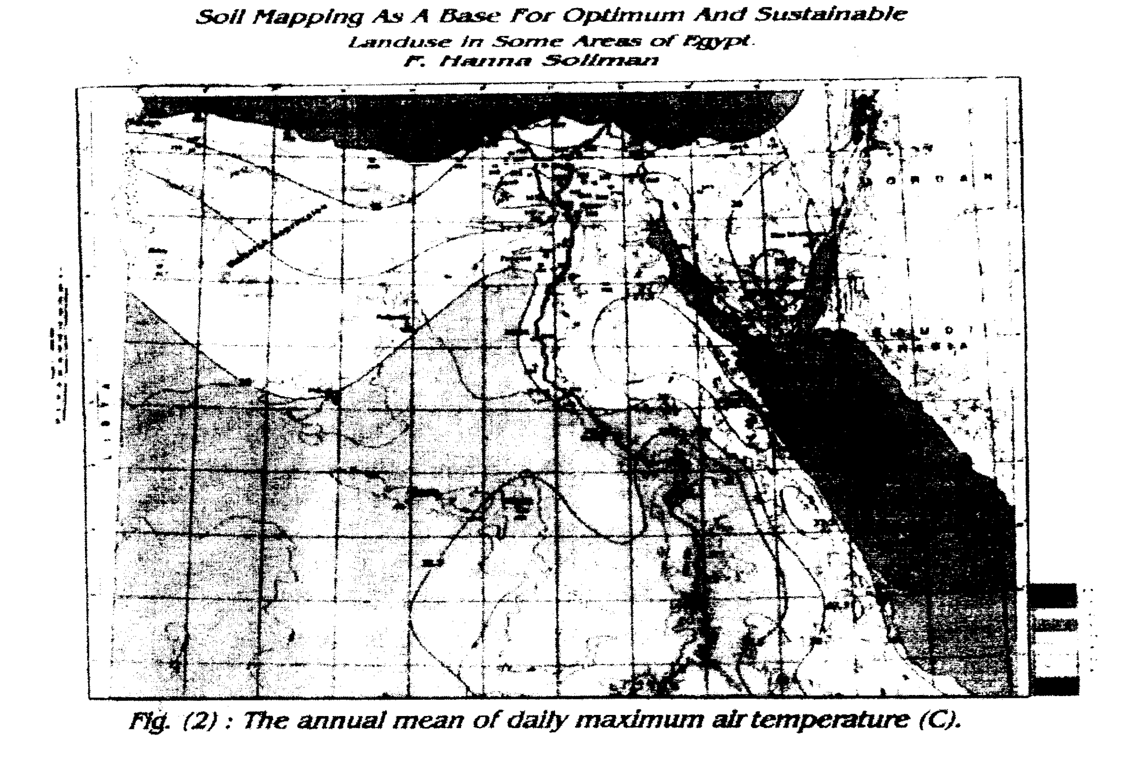


Fig. (2) : The annual mean of daily maximum air temperature (C).

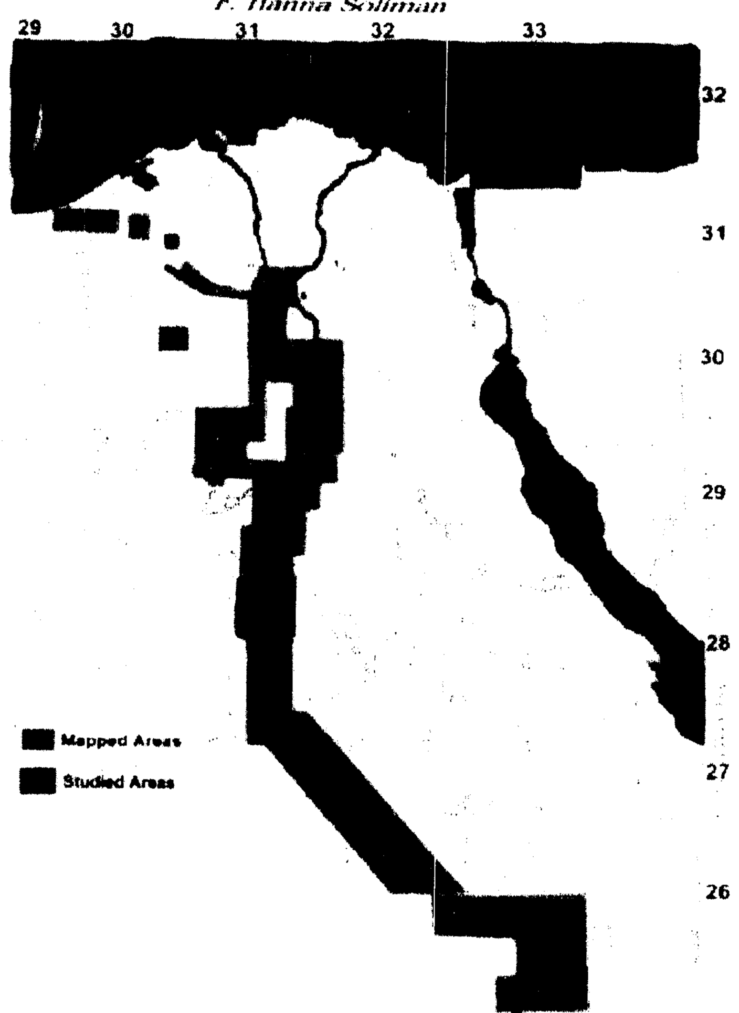


Fig. (1): Areas mapped with aerial photo-interpretion and other remote sensing techniques in Soils Dept. Fac. of Agric., Cairo Univ. (1979-1999) Supervised by Prof. Dr. F. Hanna et. al.

Mansour, M.A. (1983). Pedological studies and mapping of some soils in the northern area of the Nile Delta, Egypt. Ph.D. Thesis, Fac. of Agric., Cairo Univ., Egypt.

Soil Survey Staff (1998). Keys to Soil Taxonomy. United States Department of Agric., National Resources Conservation Service, Eight Ed.,1998, USA.

Sys, C. (1985). Land Evaluation, 3 parts, 352 pp. Publication Agricole No.7. Administration General de la Cooperation au development, Bruxelles, Belgium.

Sys, C. and Verheye, W. (1978). An Attempt to The Evaluation of physical Land Characteristics for irrigation according to FAO framework for Land Evaluation. State Univ. of Ghent ITC, Ghent, Belgium.

Sys, C.; Van Ranst, E.; Debavey, J. and Beernaert, F. (1993). Land Evaluation. parts I, II and III. Agric. Pub. No.7, GADC, Brussels, Belgium, 197p.

moderately suitable areas (S2) form about 9% of the total area, the marginally suitable lands (S3) form about 57% of the total area. These marginally suitable lands have high deficiencies as their salinity is 4-16 dS/m, sodicity is 15-30%, their texture is coarse sand. The not suitable lands (N) cover about 34% of the total area, and they have constraints in soil salinity, sodicity, $CaCO_3$ and gypsum content and forms, very coarse textures, in addition to lack of fertility.

The available artesian water in this area could be used to irrigate 15,000 feddans, which is equal to the moderately suitable areas(S2) which form 15870 feddans.

Acknowledgment

The author wishes to express his sincere gratitude to Mr. Pearlie S. Reed, Cheif of the National Resources Conservation Service, U.S. Dept. of Agric.; Dr. Mark A. Nearing, Co. Chair, 10 th ISCO Conference, and other members of organizing committee for their kind support for attending the10 th ISCO meeting.

Also thanks and gratitude to the authorities of Cairo University, Ministry of high education and Scientific Research Acadmy for their help.

REFERENCES

Abd El Koy, W.A. (1998). Soil mapping as a base for optimum landuse in some areas of El Bustan, west of Nile Delta, Egypt. M.Sc. Thesis, Fac. of Agric., Cairo Univ., Egypt.

Abou El Enain, A. Sh. (1997). Use of GIS, remote sensing and aerial photo-interpretation Nile Delta, Egypt. Ph.D. Thesis, Fac. of Agric., Cairo Univ., Egypt.

Egyptian Meteorological Authority (1996). Climatic Atlas of Egypt, Cairo, Egypt.

El Nahry, A. H. M. (1997). Using aerial photo-techniques for soil mapping in some areas east of the Nile Delta. M.Sc. Thesis, Fac. of Agric., Cairo Univ., Egypt.

Hanna Soliman,F.(1997).Physiography and soils of Egypt. International Symposium on

Sustainable Management of Salts Affected Soils in The Arid Ecosystem. Cairo Egypt.

Hanna, F. and Erain, W.F. (1992). Necessity of update national soil survey plan of Egypt for the year 2000. Proceeding of the first national conference on land reclamation and development in Egypt. El Minia, Egypt 1992, pp.285-305.

Magd, M.H. (1979). Physiography and soils of the northern coastal zone of the Nile Delta, Egypt. Ph.D. Thesis, Fac. of Agric., Cairo Univ., Egypt.

Maher, A.O. (1996). Soil mapping of Wadi El Farigh, Western Desert, Egypt, using aerial photo-interpretation and other remote sensing techniques. M.Sc. Thesis, Fac. of Agric., Cairo Univ., Egypt.

are the main limiting factors in these areas. Land improvement practices in such areas include leaching, improvement of drainage, structure and soil fertility.

3- The third area is located in El-Bustan expansion region, west of the Nile Delta. It is sandy area with sand dunes, and irrigated from El-Nuberaya canal through El-Bustan canal. It is a level area, in which the differences in height varies between +25m and 45m above sea level.

The reclaimed areas are distributed among the university gratuates (30,000 Fed.), cooperative (5000 Fed.) and investors (40,000 Fed.).
The physiographic soil map of the area is shown in Fig.(7) and indicates that the main physiographic soil units could be summarized in the following:

3-1 Soils of old river terraces which are sandy, non-saline, with $CaCO_3$ content 0.6-13%(cover about 63% of the total area).
3-2 Soils of aeolian deposits which are similar to the above soils but coarser in texture (cover about 33 % of the total; area).
3-3 Rocky areas which form about 4 % of the total area.

The soils of this area could be classified as : Typic Torripsamments and Typic Petrocalcids. Wind erosion is considered the main constraint in this area. The wind erosion control by several means is the main soil conservation practice. Reducing field wdith along the prevailing wind direction (north-west and north directions), strip cropping, establishing wind barriers, roughing of the land surface, maintaining of vegetative residues to protect soil surface are the most common practice by farmers to conserve these soils. Another important practice is stabilizing the power of sand dunes at its active point, in addition to leveling of large hummocks and the dune crest, stabilizing the side facing the prevailing wind are very important to control wind erosion. Also cultivation of tolerant crops such as Barley, Flax, Oats, Wheat, Millet, and Sunflower are highly recommended.

4- The fourth area is Wadi El Farigh area in western desert, between Cairo and Wadi El Natrun. The lowest point in the valley is -4m while the highest point is +100 m ASL. It extends far about 70 Km in east-west direction with a width of 7-10Km. Wadi El-Farigh is one of the prominent topographic depression at kilometer 50 from Cairo-Alexandria highway. It was an old stream from old River Nile channels to extend from east to west and joined with Kanoby old river which was extended from south to north in Western desert. The physiographic soil map of this area is shown in Fig.(8) and shows that the main landtypes are Hillands (50.6%), Plateaux(9.8%), Pedimonts(1.6%),Penplains(15%), Plains(19%), Terraces(1.6%) and dry valley (2.4%). The dominant soils in these landtypes are:
Typic Torripsamments, Lithic Torripsamments, Typic Quartzipsamments, Typic Torriorthents, Typic Haplocalcides, Typic Gypsicalcides, Typic Calcigypsides, Typic Natriargides, Calcic Haplogypsides and Sodic Haplogypsides. The land suitability of these lands (according to Sys and Verhey(1978) and Sys (1985); and Sys *et al* (1993) indicated that

Although, Egypt receives low annual precipitation totals, it is fortunate in having one of the largest rivers in the world. Mean minimum and maximum temperatures and mean annual precipitation normals during the period 1960-1996 are presented in Figures 2, 3 and 4 according to the Climate Atlas of Egypt, published by Egyptian Meteorological Authority (1996).

RESULTS AND DISCUSSIONS

Four representative areas are selected to show the different models of soil formations and different sorts of constrains.

1- The first area is the coastal zone of the Nile Delta. The Nile Delta measures about 175 Km from south to north, and some 220 Km from east to west along its base at the north. The general slope of the Delta between Cairo and the sea is 12 m in 170 Km.The physiographic soil units in the coastal zone are: Coastal aeolian deposits-soils, Beach deposits-soils, Lagoonal deposits-soils, and Fluvio-marine deposits-soils.

   Fig.(5) represents these soils and indicates that the main constraints in these soils are coarse sandy texture, water and wind erosion, the high water table level and its high salinity due to the sea effect.

   The wind breaks cultivation along the north and north-west sides, leveling of sand dunes and hummocks, and organic matter applications are the most common practices by farmers in sandy dunes and sand sheets areas.

   The drains instillation and clearing of present drains, salinity leaching, deep ploughing and gypsum applications are common practices in reclamation of saline and alkaline low lands.
   The dominant soils in these areas according to soil Taxonomy bases (1998) are:
   Typic Psammaquents, Typic Epiaquents, Aquic Quartzipsamments, Aquic Torriorthents, Typic Torripsamments, Typic Aquisalides, Typic Haplosalides, Typic Haplonatrargides, Sodic Aquicambides, Sodic Haplocambides, Fluventic Haplocambides and Typic Haplocambides.

2- The second area is south Port-Said plain which extends west of Suez Canal and north-east of the Nile Delta. It represents the low lands soils consrtaints. Four geomorphic units are identified, namely: coastal plain, young deltaic plain, aeolian plain, and old deltaic plain. Fig.(6).The dominant soils on these geomorphic units are:
   Typic Aquisalids, Typic Torripsamments, Typic Haplosalids, Typic Petrogypsides and Vertic Torrifluvents.
   The soil constraints in these areas are coarse texture and single grain structure in sandy soils and wind born deposits, and low fertility of these areas.

   The soil of gypsiferrous deposits are actually and potentially not suitable for agriculture, and could be used as raw material for gypsum production. The flooding coarse texture, salinity, soil depth, and high gypsum content

properties and vulnerability. So, proper soil mapping is considered as base for optimum land and water conservation.

There are several trials of soil mapping of Egypt in different ways since 1964, as presented by . Hanna and Erian 1992. Recently, the author and his co-workers since 1976 started and still going on a physiographic soil mapping program to cover the most promising areas for agriculture in Egypt, as well as old cultivated lands.

This current study focuses on four representative areas in Egypt, from the soil constraints and conservation points of view.

MATERIALS AND METHODS

The studies started on the year 1976 and still going on till the year 2000, covering an area of ?4,763,342 feddans*, using aerial photo-interpretation, remote sensing techniques.Fig.(1). GIS was helpful tool to integrate the geographic, geomeorphological, geological and soil information in mapping of the investigated areas. Out of the studied areas, four representative areas are selected for this study. Fig.(1).

1- The first area is located in the northern coastal zone of Nile Delta, between two Nile branches (Rosetta and Domiatta), (longitudes 30? 20` and 31? 29` east; latitudes 31? 17` and 31?45` north). Aerial photo-interpretation of 77 runs consist of 344 photos, were taken in 1956 and 1962, scale 1:20,000 were analysed and physiographic soil maps were complied. The photo-interpretation data, field survey and soil analyses, in addition to the other necessary information were integrated together to produce such maps. The total area is 607,881 feddans.
2- The second area is low lands area, north-east of the Nile Delta and west of Suez canal(longitudes 32? 10` and 32? 20` east, and latitudes 30? 40` and 31? 10` north). The physiographic soil map of this area is based on aerial photo-interpretation of 2 runs consists of 22 photos were taken in 1991, scale 1:40,000. This area covers an area about 131,372 fed.
3- The third area is located west of Nile Delta in the western desert and represents the newly reclaimed desertic lands, irrigated with Nile water. (longitudes 30? 27` and 30? 40` east, and latitudes 30? 09` and 30? 30` north). It covers an area of 75000 feddans and covered with 11 **65** photos of 5 runs scale 1: 40,000 were taken in 1990 and compared with 37 photos of 8 runs were taken in 1995, scale 1:20,000
4- The fourth area is a desertic area irrigated with artesian underground water. It is located west of the Nile valley and south-west of the Nile Delta. It is old main dry valley in the western desert named Wadi El-Farigh (longitudes 30? 10` and 30? 25` east, and latitudes 29? 50` and 30? 10` north). The complied map based on interpretation of 82 photos of 18 runs, scale 1:20,000 were taken in 1965. It covers an area of 175,171 feddans.

SOIL MAPPING AS A BASE FOR OPTIMUM AND SUSTAINABLE LAND USE IN SOME AREAS OF EGYPT

F. Hanna Soliman*

* Cairo University, Faculty of Agriculture, Soils Dept., Giza, Egypt.
E.mail: Fouadhanna@ FRCU.EUN. EG

ABSTRACT

Egypt is a large, arid and for the most part low-lying country on the north-east African penplain, exceptions to this general rule can be found along the northern coast, where climate is semi-arid, the total land area is 1,001,449 Km^2. Phsiographic and pedological constraints to agriculture in Egypt are immense. These include salinization, alkalinization, and water logging of soils in Nile Valley and Delta. Upland soils fare little better; in these areas the low water holding capacities and inherent low fertility make soil management difficult. Dune encroachment on the agricultural land and shifting sand present problems all over the country.

This current work presents 4 models of soil mapping in four representative areas for horizontal expansion in Egypt. The first area represents the coastal zone of the Nile Delta, the second one is located in the northern east part of the Nile Delta and represents the low lands, the third one is a desertic area west of the Nile Delta in the Western desert and represents the newly reclaimed desertic lands irrigated with Nile water, and the fourth area is a desertic dry valley area in Western desert, irrigated with artesian ground water. The studies focus on soil mapping using aerial photo-interpretation and other remote sensing techniques as well as GIS. The field work and laboratory analyses with special reference to soil constrains and water resources were the main targets to reach land evaluation and land suitability goals.

The physiographic and soil maps scales 1:20,000, 1:50,000 and 1:100,000 as well as the land suitability for main crops, fruit crops and vegetables were the final goal of these studies.

INTRODUCTION

Egypt suffers continued population growth and dwindling resources. With Egypt's population(62 millions) concentrated in the Nile Valley and Delta, which constitutes less than 4 percent of the total area of the country, development of its deserts to make them productive and habitable is an urgent need that is widely recognized.

In order to solve the problems of food and housing for the continuously increasing population, the Egyptian government has decided to expand horizontally (in desertic fringes) as well as continuing the present successful vertical improvement of its cultivable lands. We could not plan and control the use of soil resources without exploring and evaluating its extent, distribution,

Swift, M.J.; Vandermeer, J.; Ramakrishnan,P.S.; Anderson,J.M.;Ong,C.K. and Hawkins, B.A. (1996) Biodiversity and agroecosystem function. In: H.A.Mooney, J.H. Cushman, E.Medina, O.E. Sala and E.-D. shulze (Eds.) functional Roles of Biodiversity : A Global Perspective. SCOPE, John Wiley: 261-298.

Wallwork, J.A. (1976) The distribution and diversity of soil fauna. Academic Press, London: 355 pp.

REFERENCES

Cancela da Fonseca, J.P. (1991) Ecological diversity and ecological systems complexity: local or global approach. Rev. Biol. Sol 28: 51-66.

Gadallah, N. S. and Mikhail, W. Z. A. (1999) Activity density of soil fauna in cultivated lands. I. - Soil mesofauna associated with mixed fruit trees. Egypt J. Zool. 32: 243-253.

Ghabbour, S.I. (1991) Towards a zoosociology of soil fauna. Rev. Ecol. Biol. Sol 28: 77- 90.

Ghabbour, S.I. and Shakir, S.H. (1981) Some features of important taxa of soil mesofauna in an Afro-Mediterranean desert. I-General consideration of soil mesofauna in agro-ecosystems. Cairo Univ. Afr. Stud. Rev. 10: 1-21.

Ghabbour, S.I.,; Rizk, M. A. And Mikhail, W.Z.A. (1994) Multivariate analysis of pest incidence in polyculture agro-ecosystems in Fayoum, Egypt. Proceeding of the International Meeting "Ecology and Statistical Methods ", Niort, France, 5-6 October 1994: 207-214.

Greenacre, M.J. (1984) Theory and application of correspondence analysis. Academic press, London :363pp.

Greenslade, P.J.M. and Greenslade, P. (1983) Ecology of soil invertebrates. In :Soil : An Australian Viewpoint, Division of Soils, CSIRO: 645-669.

Honek, A. (1988) The effect of crop density and microclimate on pitfall trap catches of Carabidae, Staphylinidae (Coleoptera), and Lycosidae, (Araneae) in Cereal fields. Pedobiologia 32: 233-242.

Hussein, A. M. and Mikhail, W. Z. A. (1998) Evaluation of Agricultural pests in tuber crop plantations in Menofiya Governorate. Menofiya J. Agric Res. 23(3): 639-649.

Kromp, B. (1990) Carabid beetles (Coleoptera: Carabidae) as bioindicators in biological and conventional farming in Austrian potato fields. Biol.Fert. Soils 9: 182-187.

Mikhail, W.Z.A. (1993) Effect of soil structure on soil fauna in a desert wadi in Southern Egypt. Journal of Arid Environments 24: 321-331.

Mikhail, W.Z.A. (1996) Diversity of soil mesofauna in the Mariut region, Egypt. Zoology in the middle East. 12: 109-117.

Mikhail,W.Z.A. (1998) Activity density of the epigeic soil mesofauna in northern Sinai, Egypt. Zoology in the middle East 16: 111-120.

Mikhail, W.Z.A. and Gadallah, N. S (1999) Activity density of soil fauna in cultivated lands. I. - Soil mesofauna associated with a citrus. Egypt J. Zool. 32: 255-266.

Mikhail, W.Z.A. and Hussein, A.M. (1997) Activity density of soil mesofauna associated with potato fields in Menofiya Governorate, Egypt. Egypt J. Zool. 28:139-147.

Perfecto, I. and Sediles, A. (1992) Vegetational diversity, ants (Hymenoptera: Formicidae) ,and herbivorous pests in Neotropical agroecosysten. Environmental Entomology 21 (1): 61-67.

Roux, M. (1985) Algorithmes de classification. Masson, Paris :151pp.

Roux, M. (1987) DATAVISION 1.2 logociel d'analyse de donnees. Montpellier, CEPE/CNRS. 30pp.

Rizk, M.A. and Mikhail, W.Z.A. (1999) Impact of no-tillage on soil fauna diversity. Zoology in Middle East 18: 113-120.

Southwood, T.R.E. and Henderson, P. M. (2000) Ecological Methods Blokwell Science Ltd., Oxford: 574 pp.

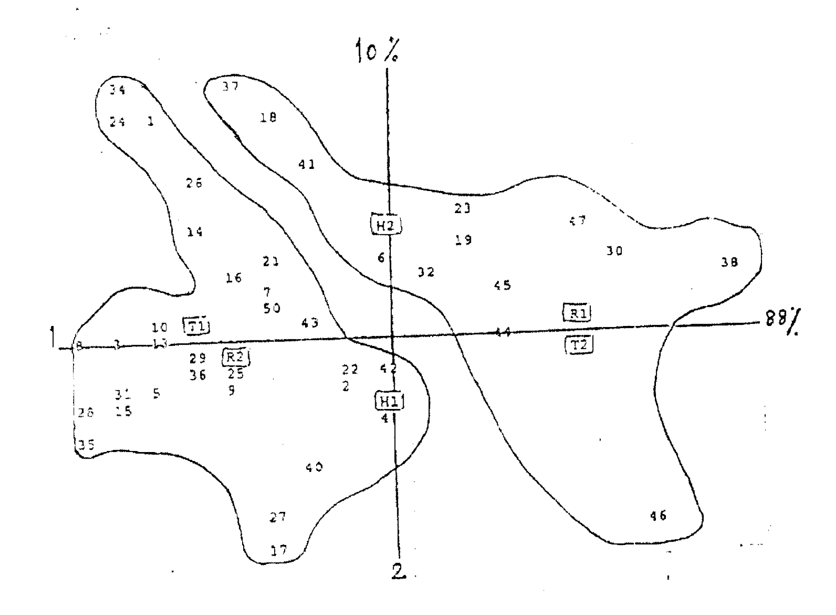


Fig. (2) Graphical representation of the application of CA and AHC methods after applying disjunctive coding method to data of Table (2) and Table (1). Letters: T, Temperature: R, Rainfall; H, Relative humidity. 1 and 2 are for lower and higher classes of this factors. 1-50 are species and/or higher taxa as explained in Fig. (1). Point 16 with 20; 45 with 48; 13 with 33; R2 with 12; 25 with 39; 4 with 11; 40 with 49

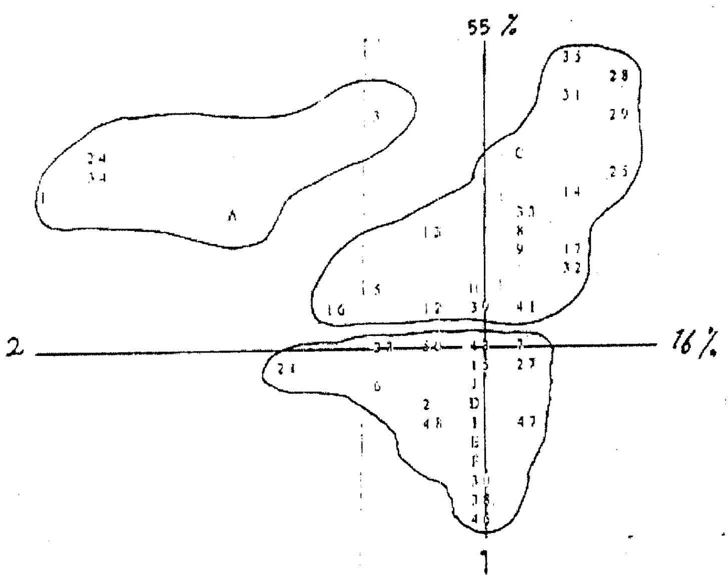


Fig. (1) Graphical representation of the application of CA and AHC methods to data of the activity density of soil fauna species and/or higher taxa. Letters: A, February; B, March; C, April; D, May; E, June; F, July; G, August; H, September; I, October; J, November; 1-50 are species and/or higher taxa: 1,Acarina; 2, Araneida; 3,Collembola; 4,Coleoptera; 5, Anthicus sp.; 6,Notoxus sp.; 7,Sitophilus sp.; 8,Elateridae; 9,Pentodon sp.; 10,Staphilinidae; 11,Zophosis sp.; 12,orhers; 13,Diptera; 14,Anthomyiidae; 15,Calliphoridae; 16,Chironomidae; 17,Chloropidae; 18,Dolichopodidae; 19,Fanniidae; 20,Musca domestica; 21,Otiidae; 22,Pipunculidae; 23,Phoridae; 24,Psychodidae; 25, Sarcophagidae; 26,Sciaria sp.; 27,Sepsidae; 28,Sphaeroceridae; 29,Syrphus corollae; 30,Tachinidae; 31,Tephretidae; 32,Embioptera; 33,Heteroptera; 34,Aphidiidae; 35,Cercopidae; 36,Cicadellidae; 37,Braconidae; 38,Bethyloidae; 39,Chalcididae; 40,Camponotus sp.; 41,Cardiocondyla sp.; 42Cataglyphes sp.; 43,Monomorium sp.; 44,Pheidole sp.; 45,Sphecididae; 46,Lepidoptera; 47,Neuroptera; 48, Orthoptera; 49,Trichoptera; 50,Isopoda.
Point A with 26; B with 10,20,36; 12 with 18,37; 7 with 40; 15 with 42; 27 with49; D with 11; I with 4,44; E with G; F with H,19,22; 30 with 45.

Table (2): Climatological normal at Beni-Suef Governorate

Month	Man Temperature	**R.H. %**	Rainfall (mm)
February	14.5	48	0.9
March	17.6	41	0.7
April	22.0	36	0.2
May	25.8	35	0.1
June	28.7	36	0.0
July	29.1	43	0.0
August	28.9	47	0.0
September	27.4	47	0.0
October	23.6	49	0.0
November	18.6	57	2.5
Low	23.6	43	0.0
High	29.1	57	2.0

Table (3): Alpha, beta and gamma diversities of herbivores, detritivores and carnivores in months of the present study

Months	Detritivores		Herbivores		Carnivores	
	Alpha	Beta	Alpha	Beta	Alpha	Beta
February	1.19	1.64	1.72	1.24	0.65	2.69
March	4.71	0.41	1.50	1.43	1.45	1.21
April	1.87	1.04	1.59	1.35	1.49	1.17
May	2.09	0.93	1.20	1.78	1.24	1.41
June	1.93	1.01	0.89	2.40	1.23	1.42
July	1.14	1.71	0.41	5.22	1.23	1.42
August	1.45	1.34	0.80	2.68	1.59	1.10
September	2.24	0.87	0.67	3.19	1.86	0.94
October	1.96	0.99	0.43	4.98	2.02	0.87
November	1.96	0.99	1.19	1.80	1.55	1.13
Gamma	1.95		2.14		1.75	

Table (1) Activity density (ind./pitfall trap) of species and/or higher taxa of soil fauna during the period between Februray 1995 and November 1995 at Beni-Suef Governorate.

Taxa	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**
Acarina	36	8	9	2	2	0	1	3	1	2
Araneida	8	16	13	44	41	16	11	5	11	7
Collembola	161	60	410	70	9	0	0	1	19	12
Coleoptera	0	3	1	3	5	4	0	1	0	0
Anthicidae										
Anthicus sp.	3	0	4	8	0	0	1	0	0	1
Notoxus sp.	20	15	16	33	22	9	14	26	14	5
Curculionida										
Sitophilus sp.	0	0	1	2	0	0	0	0	1	1
Elateridae	0	1	1	1	0	0	0	0	0	0
Scarabaeidae										
Pentodon sp.	1	2	9	4	1	1	1	2	0	0
Staphilinidae	0	2	1	1	1	0	0	0	0	0
Tenebrionidae										
Zophosis sp.	7	6	29	40	37	31	19	5	13	10
Others	13	1	22	37	4	1	4	4	5	6
Diptera	9	4	30	18	0	1	2	3	0	8
Anthomyiidae	0	1	3	0	0	0	0	0	0	2
Calliphoridae	0	0	1	4	0	0	0	0	0	1
Chironomidae	4	4	3	2	7	0	0	0	0	3
Chloropidae	0	0	1	0	1	0	0	0	0	0
Dolichopodidae	1	25	3	5	1	0	1	1	10	2
Fanniidae	0	0	0	5	1	0	0	2	4	1
Muscidae										
Musca domestica	1	7	6	5	1	0	2	2	1	1
Otitidae	1	0	0	2	0	0	0	0	1	0
Pipunculidae	0	0	0	4	1	0	0	1	1	0
Phoridae	3	0	3	0	3	1	0	1	6	1
Psychodidae	4	1	2	0	0	0	0	0	0	1
Sarcophagidae	0	0	8	1	0	0	0	1	1	1
Sciaridae										
Sciaria sp.	9	5	6	1	3	0	0	0	0	5
Sepsidae	0	0	2	5	1	1	1	0	0	0
Sphaeroceridae	0	3	11	0	0	0	0	0	0	0
Syrphidae										
Syrphus corollae	0	1	5	0	0	0	0	0	1	0
Tachinidae	0	0	0	2	1	0	3	0	5	1
Tephretidae	21	143	641	31	8	1	0	1	11	25
Embioptera	0	0	4	0	0	0	1	0	3	1
Heteroptera	0	3	5	2	1	0	0	0	0	1
Homoptera										
Aphidiidae	59	38	18	1	1	0	0	1	1	6
Cercopidae	5	2	45	1	0	0	0	1	0	0
Cicadellidae	4	10	37	43	8	3	1	5	6	9
Hymenoptera										
Braconidae	0	6	0	0	1	0	0	0	1	0
Bethyloidea	0	0	0	0	1	0	2	1	2	0
Chalcididae	1	6	9	9	5	0	2	1	3	0
Formicidae										
Camponotus sp.	1	9	29	13	36	9	6	1	3	1
Cardiocondyla sp.	3	1	33	4	8	3	1	0	0	68
Cataglyphes sp.	7	30	39	26	36	32	15	21	6	2
Monomorium sp.	36	206	193	236	152	77	84	101	57	44
Pheidole sp.	191	338	540	909	813	1446	446	761	496	390
Sphecidae	0	0	0	2	2	1	0	3	0	1
Lepiodoptera	0	0	0	0	1	1	1	0	0	0
Neuroptera	0	0	4	0	3	3	2	7	3	5
Orthoptera	4	2	2	6	6	6	11	4	3	8
Trichoptera	0	0	5	5	9	0	0	1	1	1
Isopoda	9	17	24	34	23	5	1	7	4	19

consequently lead to the reduction of the abundance of herbivores excluding ant species and increase ant foraging activity. In the present investigation ants (Formicidae) are considered as herbivores.

Changes in soil functioning whether natural or provoked by man induced disturbances resulting in subsequent changes in the composition of the community of soil fauna that could be easily detected with appropriate statistical techniques (Ghabbour 1991). The effects of human activity in "natural" as well as in agro-ecosystems have studied (Ghabbour and Shakir 1981, Mikhail 1996 and 1998). These studies revealed that populations and groups of soil animals are remarkable for their stability and resilience as well as their persistence even during adverse changes occurring within a severely perturbed ecosystem. The relation between diversity index for function groups and climatic records was significant only with temperature for alpha, and beta diversities of herbivores and carnivores, this is explained by the fact that herbivores appear more in the disturbance system of less stability while detritivores appear more in systems which have a certain degree of stability.

Running activity of soil fauna increased with temperature (Honek 1988) and has probably a major effect on catch. Within month temperatures were largely differentiated. Within month temperatures were largely differentiated. The effects of weather, monthly catches increased with temperature (Honek 1988), support climatic explanation of activity differences.

diversity (H?) (the rate at which species and/or taxa are changed or replaced between or within months), of the trophic groups (herbivores, detritivores, and carnivores) for sampled months, are shown in Table (3). Shannon's index of diversity (H?) of detritivores are higher followed by carnivores and herbivores, while beta diversity (H?) of herbivores are higher followed by carnivores and detritivores.

DISCUSSION

In the present study, the pitfall trapping method used for investigating local and temporal changes of arthropod fauna. In agricultural fields the composition and size of catches may be influenced by factors including crop species, surrounding and foregoing crop (Honek 1988) intensity of agriculture practices (Wallwark 1976) and soil structure (Mikhail 1993). The density of plant cover is an important determinant of catch size under stands of different crop.

In the present investigation, different fruit trees were cultivated which lead to marked differences in numbers of species and/or higher taxa sampled. On the other hand, the intensity of agricultural practices is minimum in the case of these fruit trees cultivated in the area of Bayad El-Arab at Beni-Suef Governorate. Generally, the monthly catches under these fruit trees contain a high number of species. In other agro-ecosystems, where agricultural practices are maximum, they contain lower number of species (Mikhail and Hussein 1997, Hussein and Mikhail 1998).

The study of trophic (functional) groups among the populations of soil fauna is important in order to evaluate the structural composition of these groups in different ecosystems (Ghabbour 1991) and illustrate the degree of complexity of food chains occurring in such agro-ecosystems (Mikhail and Hussein 1997, Hussein and Mikhail 1998). In the present study, the three main trophic groups; herbivores (potential agricultural pests), detritivores (essential for biological soil fertility) and carnivores (natural enemies of herbivores); are well represented during the study period. These results suggest that there are complex food chains in the area of the present investigation. This phenomenon was found associated with potato cultivations (Mikhail and Hussein 1997) and tuber crops (Hussein and Mikhail 1998) in the area of field crops around Shibin El-Kom in the Delta. Perfecto and Sediles (1992) found that the abundance of herbivores would be less in the biculture than in the monoculture and the ant foraging activity would be higher in biculture. On the other hand, Ghabbour et al.(1994) and Hussein and Mikhail (1998) found that herbivores are less abundant when crops form a mosaic pattern of cultivations. In the present study, different fruit trees are cultivated in one field and form a permanent mosaic pattern of cultivation more complicated and permanent than the temporary mosaic pattern of cultivation associated with tuber crops, as a result of the presence of plant litter. This condition creates a more complex pattern of crops as well as litter of plants. This leads to the increase of detritivores (Hussein and Mikhail 1998). In the present investigation, the fruit trees cultivated are harvested either in winter or summer season. This will further increase the degree of complexity of the mosaic pattern of cultivation and

separate February, March, and April months at one side and the rest of the other months of the present study, at the other side of the ordination graph. March and April months are similar to each other and characterized by 22 taxa. These taxa were Staphilinidae (Coleoptera), *Musca domestica* (Coleoptera, Muscidae), Cicadellidae, Cercopidae (Homoptera), Dolichopodidae, Chironomidae, Sphaeroceridae, Tephretidae, Sarcophagidae, Anthomyiidae, and Chloropidae, (Diptera), Braconidae, and Chalcidae (Hymenoptera), Labiduriidae (Dermaptera), *Anthicus* sp. (Coleoptera, Anthicidae), *Syrphus corollae* (Diptera, Syrphidae), *Pentodon* sp. (Coleoptera, Scarabaeidae), Elateridae (coleoptera), Heteroptera, Embioptera, *Cardiocondyla* sp. (Hymenoptera , Formaicidae), and other Coleoptera. February is characterized by Acarina, Collembola, Psychodidae (Diptera), Aphidiidae (Homoptera), and *Sciaria* sp (Diptera, Sciaridae). May, June, July, August, September, October, and November are similar to each other and characterized by 23 species. These taxa were Lepidoptera, Bethyloidae, and Sphecidae (Hymenoptera), Tachinidae, Sepsidae, Calliphoridae, Phoridae, Otitidae, Fanniidae, and Pipuneulidae (Diptera), Neuroptera, *Sitophilus* sp. (Coleoptera, Curculionidae), *Monomorium* sp., *Camponotus* sp., *Cataglyphes* sp., and *Pheidola* sp. (Hymenoptera, Formicidae), Isopoda, Araneida, *Notoxus* sp. (Coleoptera, Anthicidae), Trichoptera, *Zphosis* sp. (Coleoptera, Tenebrionidae), Coleoptera, , and Orthoptera.

In order to study the relationships of the activity density of species and or higher taxa of soil fauna and climatological data, of Table (2) the disjunctive coding method was adopted. This comprises the categorization of data into two classes, lower, and higher, the limits of these two classes are shown in Table (2). The expected value of activity density of soil of Table (1) corresponding to these two scales were determined by the contingency table method prior to the application of ordination and classification methods. Figure (2) shows results of soil fauna \ climatological data relationships produced by this data treatment. Eighty eight percent of the total variance is associated with the first (horizontal) axis and 10% with (vertical) one. Fourteen taxa thrive with severe climatic conditions (no rain, high temperature, and high relative humidity). These taxa are Lepidoptera, Tachinidae, Dolichopodidae, Phoridae, and Fanniidae, (Diptera), Neuroptera, Sphecidae, Braconidae, and Bethyloidae (Hymenoptera), *Pheidola* sp. (Hymenoptera, Formicidae), Embioptera, *Notoxus* sp. (Coleoptera, Anthicidae), *Cardiocondyla* sp. (Hymenoptera, Formicidae), Trichoptera, Thirty six taxa are dominate in favorable climatic conditions (rain, low temperature, and low relative humidity). These taxa are: Staphilinidae (Coleoptera), *Musca domestica* (Coleoptera, Muscidae), Cicadellidae and Aphidiidae (Homoptera), Chironomidae, Sphaeroceridae, Tephretidae, Sarcophagidae, Anthomyiidae, Chloropidae Psychodidae, Tachinidae, Sepsidae, Calliphoridae, Otitidae, and Pipunculidae (Diptera), Chalcidae (Hymenoptera), Labiduriidae (Dermaptera), *Anthicus* sp. (Coleoptera, Anthicidae), Cercopidae (Homoptera), *Syrphus corollae* (Diptera, Syrphidae), *Pentodon* sp. (Coleoptera, Scarabaeidae), Elateridae (coleoptera), Heteroptera, Coleoptera. Acarina, Collembola, *Sciaria* sp. (Diptera, Sciaridae). *Sitophilus* sp. (Coleoptera, Curculionidae), *Monomorium* sp., *Camponotus* sp., and *Cataglyphes* sp., (Hymenoptera, Formicidae), Isopoda, Araneida, *Zphosis* sp. (Coleoptera, Tenebrionidae), and Orthoptera .Alpha diversity (H?) and beta

--------------, and B.C. Weare. 1976b: Factors governing tropospheric mean temperature. Science, 194, 1413-1414.

Parsons. D. J., K. Yoneyama, and J.-L. Redelsperger, 2000: The evalution of the tropical western Pacific atmosphere- ocean system following the arrival of a dry intrusion. Quart. J. Roy. Meteor. Soc., 517 - 548.

Philander. S. G. 1990: El Nino, La Nina, and the southern oscillation. Academic press, Inc., San Diego, 293pp.

Reid, G. C., K.S. Gage and J.R. Mcafee. 1989. The thermal response of the tropical atmosphere to variations in equatorial Pacific sea surface temperature. J. Geophys. Res. 94, 14705-14716.

Ruping, Mo, J., Fyfe and J. Derome, 1998: Phase-locked and Asymmetric Correlations of the winter atmospheric patterns with the ENSO. Atmosphere- Ocean 36 (3), 213-239.

Tang, B., 1995: Periods of linear development of ENSO cycle and POP forecast experiments. J. Clim., 8, 682-691.

Tziperman, E., L. Stone, M. A. Cane, and H. Jarosh, 1994: El Nino chaos: Overlapping resonances between the seasonal cycle and the Pacific ocean- atmosphere oscillator. Science, 264, 72-74.

Van Der Vaartel P. C. F , H. A. Kijkstra, and F. F. Jin. 2000: The Pacific Cold Tongue and the ENSO Mode: A Unified Theary within the Zebiak-Cane Model. . J. Atmos.Sci., 57, 967-988.

Wallace J.M., and D.S., Gutzler 1981: Teleconnections in the geopotential height field during the Northern Hemisphere winter. Mon. Wea. Rev., 109, 784-812.

Xiang, Y.B. and Cheng-Lan .1993: Propagation route of the impact of El Nino event on atmospheric circulation. Chinese Science Bulletin, Beijing, China, 38(3): 225-229.

Zhang, Y., J. M. Wallace and N. Iwasaka. 1996: Is climate variability over the north Pacific a linear response to ENSO? J. Clim. 9, 1468-1478.

REFERENCES

Alexander M. A., 1992: Midlatitude atmosphere-ocean interaction during El Niño. Part II: the Northern Hemisphere Atmosphere. *J. Climate*, 5, 959-972.

Angell, J.k., 1981: Comparison of variations in atmospheric quantities with sea surface temperature variations in the equatorial eastern Pacific. Mon. Wea. Rev., 109, 230-243.

------------, and J. Korshover, 1983: Global temperature variations in the troposphere and stratosphere, 1958-1982. Mon. Wea. Rev., 111, 901-921.

Bergman, J., W., and H. H. Hendon. 2000: The Impact of Clouds on the Seasonal Cycle of Radiative Heating over the Pacific. J. Atmos. Sci., 57, 545-566.

Chang, P., 1994: A study of the seasonal cycle of sea surface temperature in the tropical Pacific Ocean using reduced models. J. Geaphys. Res., 99, 7725-7741.

Dole, R. M. 1978: The objective representation of blocking patterns. In the general circulation theory, Modeling and observations. Notes from a Colloquium Summer. NCAR/CQ6 +1978 – ASP, 406-426.

Dole, R. M. 1982:Persistent anomalies of the extratropical Northern Hemisphere wintertime circulation. Ph. D. thesis, Massachusetts institute of technology.

----------, 1986a: Persistent anomalies of the extratropical Northern Hemisphere wintertime circulation: Structure. Mon. Wea. Rev., 114, 178-207.

----------, 1986b: The life cycles of persistent anomalies and blocking over the North Pacific. Adv. Geophys., 29, 31-69.

---------, 1989: Life Cycles of Persistent Anomalies. Part I: Evolution of 500 mb Height Fields. Mon. Wea. Rev., 117, 177-211.

----------, and N. D. Gordon, 1983: Persistent anomalies of the extratropical Northern Hemisphere wintertime circulation: Geographical distribution and regional persistence characteristics. Mon. Wea. Rev., 111, 1567-1586.

Hafez, Y.Y (1997): Concerning the role played by blocking highs persisting over Europe on weather in the eastern Mediterranean and its adjacent land areas. Ph. D. THESIS, Cairo University.

Gill, A., 1982: Atmosphere- Ocean Dynamics. Academic Press, 662 pp.

Jin, F. F., 1996: Tropical ocean-atmosphere interaction, the Pacific cold tongue, and the El Nino/Southern Oscillation. Science, 274, 76-78.

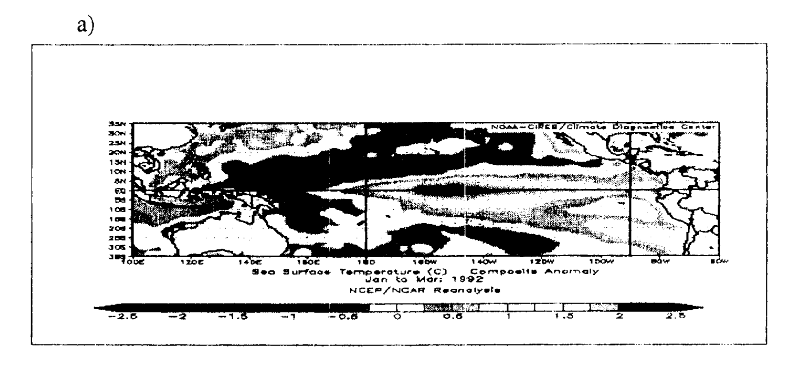
----------, J. D. Neelin, and M. Ghil, 1994: El Nino on the devil's staircase: Annual subharmonic steps to chaos. Science, 264, 70-72.

Kessler, W. S., L. M. Rothstein, and D. Chen, 1998: The annual cycle of SST in the eastern tropical Pacific diagnosed in an ocean GCM. J. Climate, 11, 777-799.

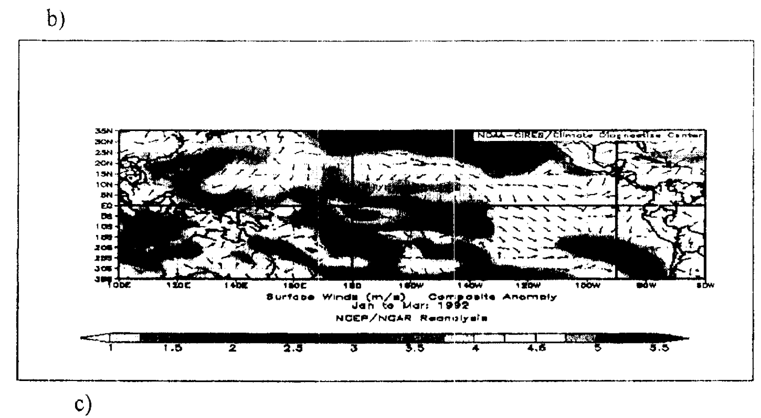
Mitchell, T. P., and J. M.Wallace, 1992: The annual cycle in equatorial convection and sea surface temperature. J. Climate, 5, 1140- 1156.

Newell, R.E. and B.C. Weare. 1976a: Ocean temperatures and large scale atmospheric variations. Nature, 262, 40-41.

a)



b)



c)

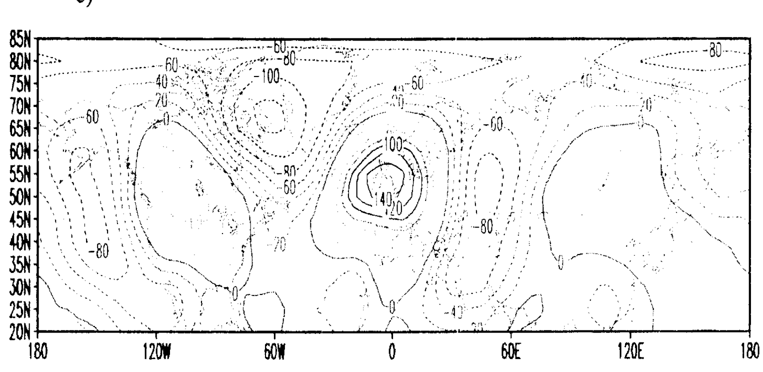


Fig.6 : Represent the anomalies during El Nino year1992 for JFM months a) in the sea surface temperature temperature in the Tropical Pacific. b) in the vector wind in the Tropical Pacific. c) in the Northern Hemisphere wintertime geopotential height at 500 hPa.

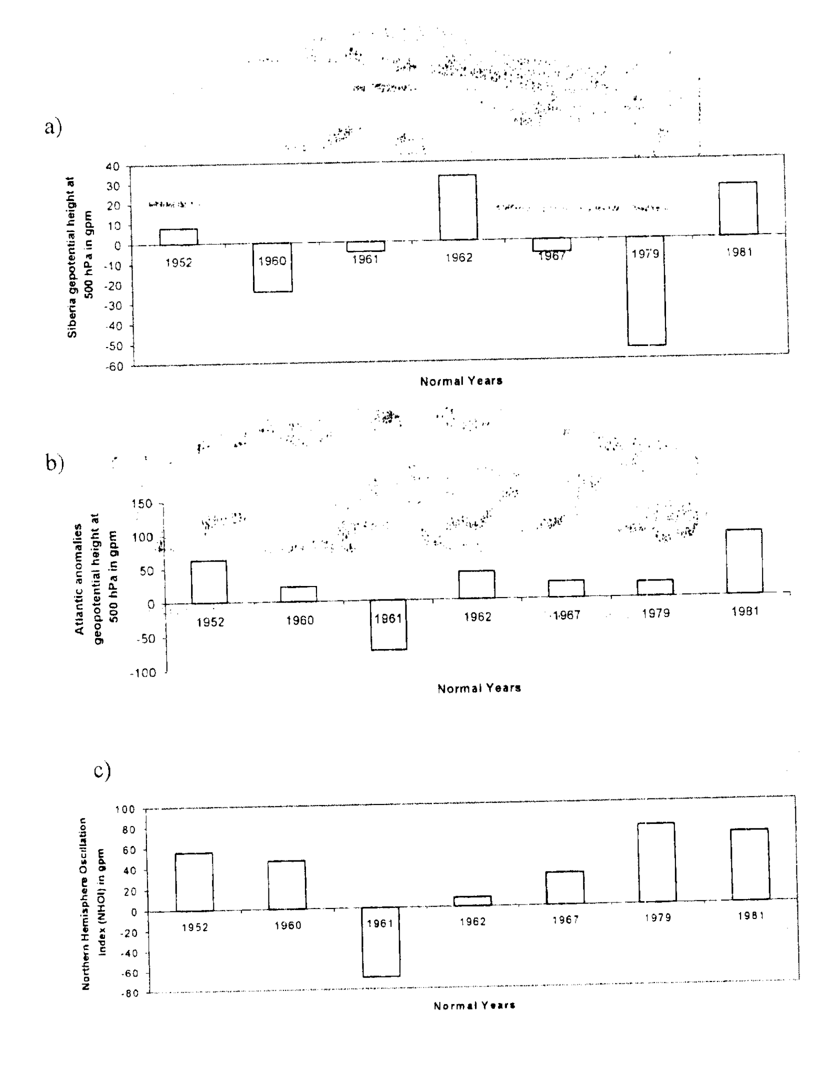
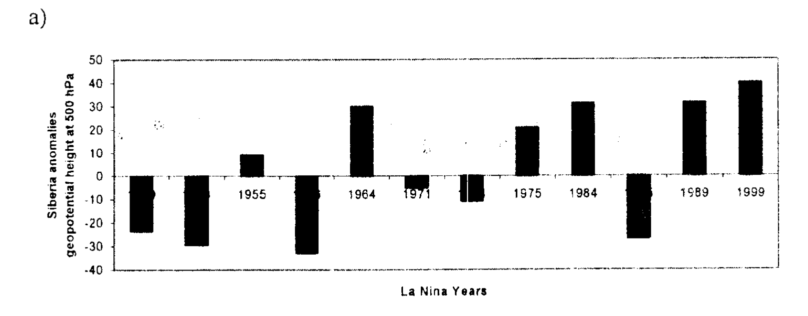
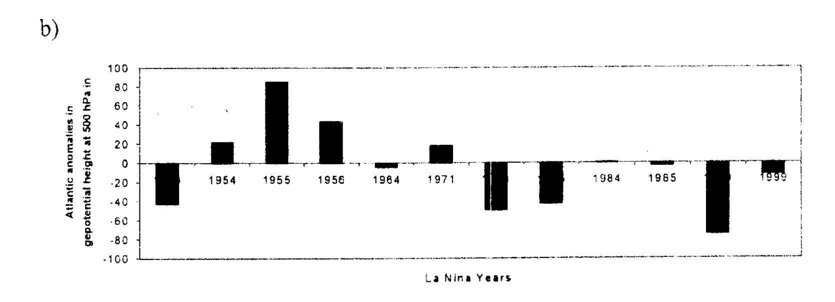


Fig. 5: Represents the Northern Hemisphere wintertime geopotential height anomalies at 500 hPa during years of Normal Cases during the period (1950-1999). a) Over Siberia. b) Over Northern Atlantic , c) Is the Northern Hemisphere Oscillation Index.

a)



b)



c)

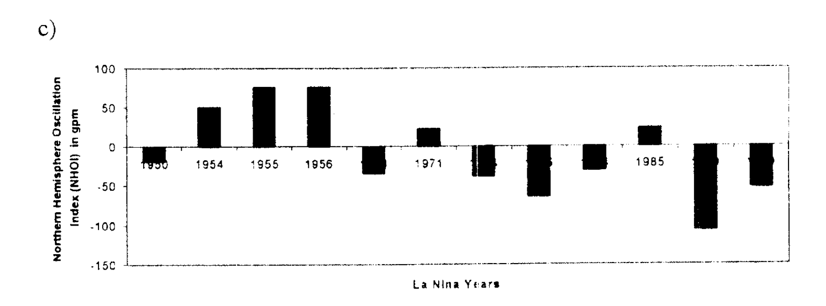
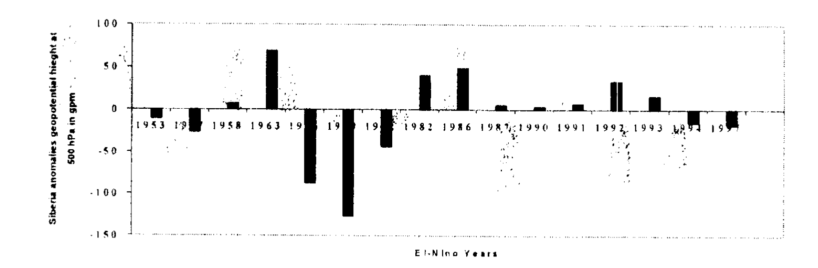
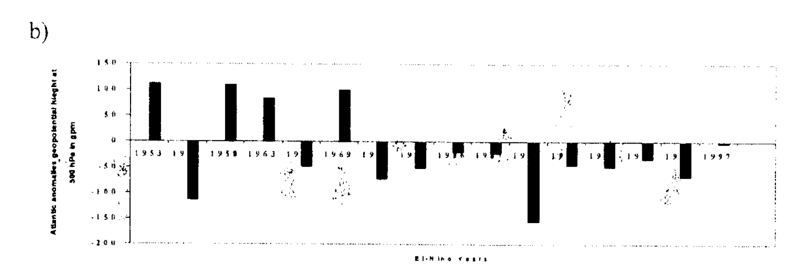


Fig. 4: Represents the Northern Hemisphere wintertime geopotential height anomalies at 500 hPa during years of La Nina Cases during the period (1950-1999). a) Over Siberia. b) Over Northern Atlantic , c) Is the Northern Hemisphere Oscillation Index.

a)



b)



c)

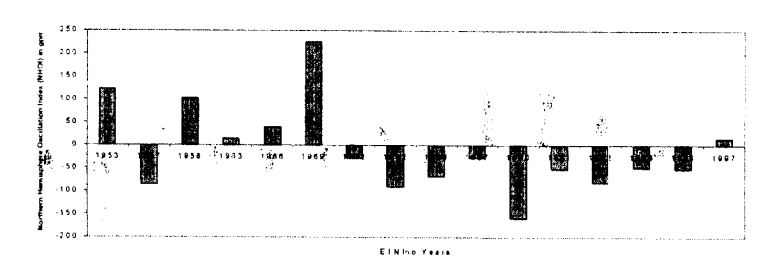
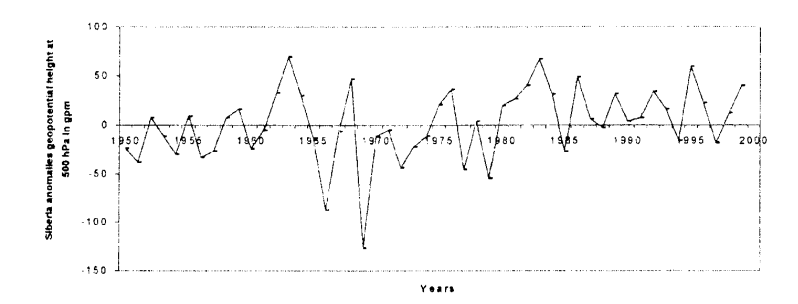
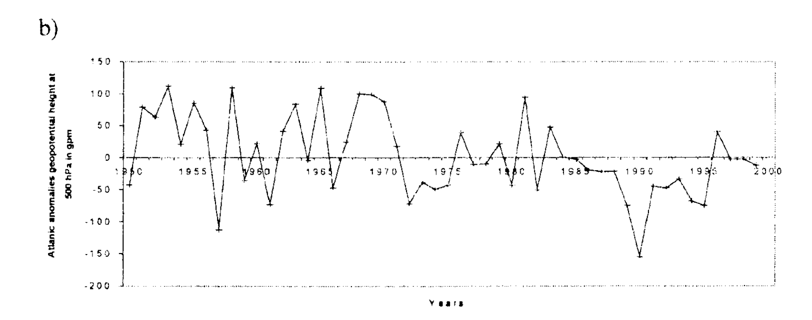


Fig. 3: Represents the Northern Hemisphere wintertime geopotential height anomalies at 500 hPa during years of El Nino Cases during the period (1950-1999). a) Over Siberia. b) Over Northern Atlantic , c) Is the Northern Hemisphere Oscillation Index.

a)



b)



c)

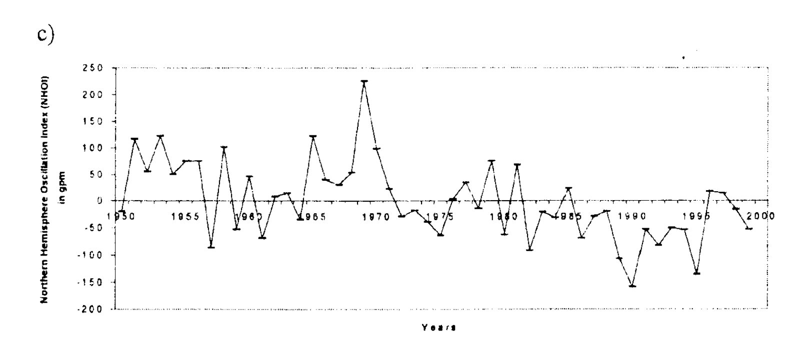
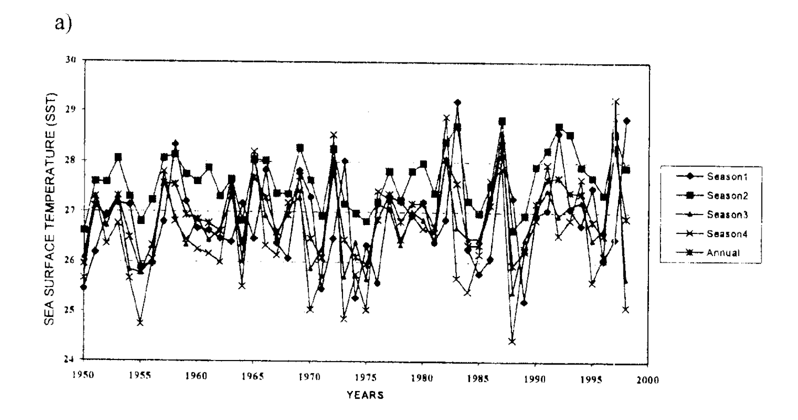


Fig. 2: Represents the variation of the anomalies in 500 hPa geopotential height. a) At Siberia key point (55? N- 100? E), b) At North Atlantic key point (55? N- 40? W). C) The North Hemisphere Oscillation Index NHOI.

a)



b)

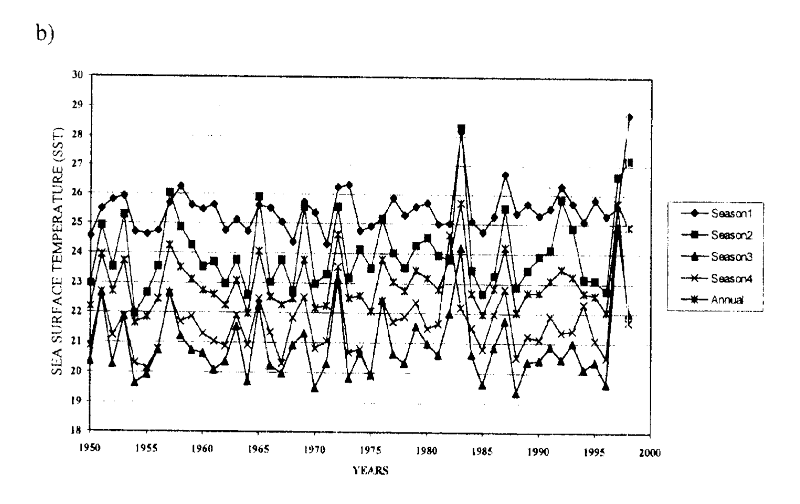


Fig. 1: Represents the distribution of seasonal and annual variations of Sea Surface Temperature SST. a) Nino 1+ 2 (0?-10? S)-(90? W- 80? W). b) Nino 3+4 (5? N -5? S) – (160? E- 90?W).

Table 2: The geopotential height anomalies in winter in the North Atlantic , Siberia, and the Northern hemisphere Oscillation Index for a nine selected synoptic cases in the Equatorial Pacific Ocean.

Years	Synoptic Case	Atlantic Geopotential Height Anomalies (gpm) A	Siberian Geopotential Height Anomalies (gpm) S	North Hemisphere Oscillation Index (NHOI) (gpm) NHOI= A-S
1960	NORMAL	22.33	-24.19	46.52
1961	NORMAL	-73.00	-04.82	-68.18
1962	NORMAL	41.46	32.64	08.82
1955	LA NINA	85.02	09.28	75.92
1971	LA NINA	17.79	-04.99	22.78
1984	LA NINA	00.90	31.38	-30.48
1991	EL NINO	-44.90	07.34	-52.24
1992	EL NINO	-47.77	34.04	-81.81
1993	EL NINO	-33.37	16.28	-49.65

Table (1): Represents the cold (C) and warm (W) , episodes by Season

Season / Year	JFM (S_1)	AMJ (S_2)	JAS (S_3)	OND (S_4)
1950	C	C	C	C
1951	C			W-
1952				
1953		W-	W-	
1954			C-	C
1955	C	C-	C-	C+
1956	C	C	C	C-
1957		W-	W-	W
1958	W+	W	W-	W-
1959	W-			
1960				
1961				
1962				
1963			W-	W
1964			C-	C
1965	C-		W	W+
1966	W	W-	W-	
1967				
1968				W-
1969	W	W-	W-	W-
1970	W-			C
1971	C	C-	C-	C-
1972		W-	W	W+
1973	W		C-	C+
1974	C+	C	C-	C-
1975	C-	C-	C	C+
1976				W-
1977				W-
1978	W-			
1979				
1980	W-			
1981				
1982		W-	W	W+
1983	W+	W		C-
1984	C-	C-		C-
1985	C-	C-		
1986			W-	W
1987	W	W	W+	W
1988	W-		C-	C+
1989	C+	C-		
1990			W-	W-
1991	W-	W-	W	W
1992	W+	W+	W-	W-
1993	W-	W	W	W-
1994			W	W
1995	W			C-
1996	C-			
1997		W	W+	W+
1998	W+	W	C-	C
1999	C+	C	C-	C

a great role in the modification of the Hadley circulation at the Pacific and also shifting the Walker circulation at the equatorial region. This shifting of Walker circulation associated with the westerly air current at the surface of Pacific Ocean near the equator. The weakening of the northeast trade winds over the North Atlantic Ocean causing a decrease of energy transfer between the Pacific Ocean and the lower atmosphere which leads to increasing sea surface temperature in the equatorial Pacific and initiate El Nino Phenomenon.

It could be concluded that the reason for the variations of sea surface temperature in the equatorial Pacific (Nino 1 +2 and Nino 3+4) may be as a result of the variability of the geopotential height anomalies in the 500-hPa North Hemisphere in winter. These results may to the formation of El Nino phenomena over the equatorial Pacific Ocean. Thus, El Nino and La Nina events are not a local phenomenon, but related to the very large-scale circulation over the North Hemisphere in winter. The negative anomalies of geopotential height over the North Atlantic Ocean, and positive anomalies of geopotential height over Siberia will be baneful for the formation and occurrence of El Nino or La Nina over the equatorial Pacific Ocean. In addition, the sea surface temperature SST in the equatorial Pacific is related to the subtropical high pressure through the wave train of North Hemisphere pattern.

Acknowledgments

The authors would like to thank the Climate and Global Dynamics Division (CGD) in the National Center for Atmospheric Research (NCAR) for data support, and the National Centers for Environmental Prediction/Climate Prediction Center and at the United Kingdom Meteorological Office. They also present thanks for the Climate Diagnostics Center (CDC); USA for the climatic charts.

500 hPa in the Northern Hemisphere in winter of 1992. It is clear that during El Nino event the westerly air current more dominant rather than the easterly air current in the Pacific region which reflect the weak of easterlies in the equatorial Pacific. There are several regions of abrupt positive or negative anomalies geopotential height. The significance negative anomaly values in the geopotential height are found over the first key point (North Atlantic Region). A positive anomaly over Europe and Siberia (second key point) is found. Also, negative anomalies in geopotential height is found in the Northern Pacific during this case of El Nino. So that the splitting in the upper westerlies air currents in the Northern Hemisphere mainly over the Northern Atlantic is the main synoptic feature accompanied with this El Nino case.

DISCUSSION AND CONCLUSION

Anomalies in geopotential height at 500 hPa in winter North Hemisphere has been investigated in relation to the seasonal and annual variations of sea surface temperature SST in the equatorial Pacific at Nino 1+2 and Nino 3+4 regions during the period from 1950 to 1999. The El Nino occurrence and its relations to the anomalies in the geopotential height in winter Northern Hemisphere were analyzed. The main results are:

1- There are dominant seasonal variation in Nino 3+4 region than in Nino 1+2 region. In general, the SST increases from year to year in the last two decades, particularly at El Nino 3+4 region.
2- In general, the SST increases from year toy year in the last two decades, particularly at El Nino 3+4 region.
3- There are mainly two key points of geopotential height 500-hPa anomalies in the North Hemisphere. First one over the North Atlantic Ocean at (55° N- 40° W). Second one over the Siberia region (55° N- 100° E). The geopotential height anomalies over each region vary from winter to winter according to the characteristics of its region.
4- During the last two decades, there are negative anomalies in the geopotential height at 500 hPa over the North Atlantic and the Northern Hemisphere Oscillation Index (NHOI) during El Nino years. The anomalies in the geopotential height at 500 hPa in Siberia are positive values during La Nina years. Meanwhile, during the Normal cases, the anomalies in the geopotential height over the North Atantic and the Northern Hemisphere Oscillation Index are positive values mainly during the l;ast two decades.The El Nino occurrence is more frequent during the last two decades and this is associated to the negative values of the geopotential height anomalies at 500 hPa over the North Atlantic Ocean and the negative values of the North Hemisphere Oscillation Index (NHOI).
5- The negative values of the NHOI during El Nino case indicates that the weaking in the northeast trade winds over the northern Atlantic Ocean. Meanwhile, it reflects the strong of the northeasterly trades over Siberia during La Nina. Meanwhile, there is positive anomalies of geopotential height over the North Atlantic Ocean and positive values of NHOI during the Normal case. The variation of the anomalies of the geopotential height at the North Atlantic Ocean and over Siberia playing

500- hPa height were examined by applying statistical techniques such as rotated principal component analysis and composite analysis, Ruping et al., (1998). They found that the Pacific /North America response to the ENSO signal during la Nina events is more significant than that during El Nino events, while the West Pacific response is stronger during El Nino events than during La Nina events. Tang (1995) noted that two to three seasons before the peak of El Nino events a strong northeastward wind stress anomaly can be identified around 10? N from 120? E to 155? W. And the Ekman drift associated with this wind stress anomaly is consistent with the southward heat transport in the early months of an El Nino year.

We analyzed the variation of the anomalies of the geopotential height at 500 hPa in winter Northern Hemisphere during 16 El Nino years, 12 La Nina years and 7 Normal years during the period under study (1950 – 1999) to investigate the relationship between them at Northern Atlantic, Siberia and index key points, see Figures 3, 4 and 5 respectively. Mixed years (begins with El Nino (La Nina) and ends with La Nina (El Nino) were executed. The results explain that, during El Nino years, there are negative geopotential height anomalies over the Northern Atlantic Ocean and there are negative values of NHOI particularly during the last two decades. Meanwhile, during La Nina cases there are a positive anomaly geopotential height over Siberia with negative values of NHOI mainly during the last two decades. In this case, the negative sign comes from the definition of this index not from the negative of the anomaly geopotential height over the Atlantic. During the Normal cases, there are positive anomalies geopotential heights over the North Atlantic Ocean and NHOI values are positive too mainly during the last two decades.

For more detail studies concerning this subject, we choose a nine cases include a different SST patterns in Pacific. The cases on 1960, 1961 and 1962 comprise the Normal cases. And another three cases concerning La Nina cases occurred on 1955, 1971 and 1984. Three El Nino cases occurred on 1991, 1992, and 1993 represented respectively, see table (2). The results demonstrate that El Nino cases accompanied with the negative North Hemisphere Oscillation Index and negative anomalies over the Northern Atlantic region. Meanwhile, Normal and La Nina cases accompanied with alternative positive or negative NHOI values.

These results may be interpreted as the occurrence of splitting in the westerlies over the Northern Atlantic at 500-hPa in winter generates a weaking in the northeast trade winds at the surface. These northeast trades change to easterlies, through the dynamical circulation, moving toward the equatorial pacific due to the Coriolis force. Simultaneously, high speed westerlies air current aloft over Siberia in winter increase the strength of the north east trades of this area that dynamically moves southward and reach the equatorial eastern part of Africa. Therefore, both atmospheric circulations of Hadley and Walker at the equator are modified by the anomalies in winter Northern Hemisphere.

Figure (6a, b) illustrates the distributions of the anomalies in the SST, and the vector wind over the pacific region during three months (JFM) on El Nino year 1992. Figure 5c , represents the anomalies geopotential height at

a) Over the key regions, there is little evidence of an atmospheric precursor until just prior to onset;
b) Development rates are often relatively rapid (full establishment of the patterns in less than a week).

Following onset, anomaly centers develop and intensify in sequence downstream from the main center, forming a quasi-stationary wave train pattern. This downstream intensification occurs with little evidence of phase propagation. Breakdowns occur rapidly. Until immediately prior to breakdown, the patterns broadly resemble the corresponding patterns immediately following development. From development through decay, corresponding positive and negative patterns display striking similarities in their evolutions.

In the present study, we suggest two suitable key points in the Northern Hemisphere. The first one, located at the Northern Atlantic (55? N -40? W) and the second point at Siberia (55? N- 120?E). We choose these two key points because the blocking of westerly air current is more frequent and dominant over these two regions in winter see e.g. Dole (1982), and Hafez (1997). The anomalies of geopotential height field of 500 hPa over these two selected key points are analyzed, see figure (2a, b). The results show that the geopotential height values over the North Hemisphere is changing from year to year around it normal values until 1980. There is gradual increase in anomaly geopotential height at 500 hPa over Siberia from 1970 to the last period. Also, most values of anomalies are positive especially in the last two decades. Meanwhile, there are negative anomalies over the North Atlantic in the same period. These results encourage the authors to define an index for the North Hemisphere Oscillations building on the anomalies in 500 hPa height over these two key points. The North Hemisphere Oscillation Index (NHOI) defined as the difference between the North Atlantic and Siberia key points of anomaly geopotential height at 500 hPa. From figure 2c, NHOI, has negative values in the almost of the last two decades.. The values of this index reflect the strength of the upper westerlies air current over the Northern Hemisphere in winter season. The negative values of the Northern Hemisphere Oscillation Index (NHOI) indicate the weakening in the westerlies aloft the Northern Hemisphere.

The relationship between El Nino and anomalies in winter Northern Hemisphere

A number of early studies have reported some strong correlations between SST anomalies in the equatorial Pacific and the tropical atmospheric anomalies, with the atmosphere lagging behind the ocean by 1-6 months see e.g., Newell and Weare (1976a,b), Angell (1981), Angell and Korshover (1983), Reid et al., (1989). The ENSO–related SST anomalies over the equatorial Pacific have significant influence on the extratropical atmospheric circulation. A large amount of variability in the 500-hPa height in the winter North Hemisphere is also strongly coupled with extratropical SST anomalies that was linearly independent of the ENSO signal in the same season, Zhang et al., (1996). Teleconnections between sea surface temperature (SST) anomalies over the Pacific and the dominant patterns of wintertime North Hemisphere

Table (1) represents Cold and Warm Episodes by Season. List of cold (La Nina) and warm (El Nino) episodes has been compiled to provide a season-by-season breakdown of conditions in the tropical Pacific. Classify of the intensity of each event by focusing on a key region of the tropical Pacific, along the equator from 150°W to the date line. The process of classification was primarily subjective using reanalyzed sea surface temperature analyses produced at the National Centers for Environmental Prediction/Climate Prediction Center and at the United Kingdom Meteorological Office. An objective procedure for classifying intensity was being explored at NCEP/CPC. In table (1), weak periods are designated as C- or W-, moderate strength periods as C or W, and strong periods as W+ or C+.

Figure (1a, b) represents the distribution of seasonal and annual variations of SST For El Nino 1+2 and El Nino 3+4 regions during the period of 1950-1999. We found that the disturbances in SST increased during the last two decades. This increase of seasonally and annual SST disturbances was dominant at region El Nino 3+4 rather than at region El Nino 1+2. From Table (1) the occurrence of El Nino event became more frequent through the two last decades. There are 16 El Nino, 12 La Nina case, 7 normal cases, and 15 cases had a mixing cold and warm episodes events during the period under study (1950-1999). 8 El Nino cases and 4 La Nina cases only are found during the last two decades. In addition, the period from 1990 to 1994 is associated with positive anomalies in SST (warm) in the equatorial eastern Pacific, and recorded successive El Nino events.

The Northern Hemisphere 500 hPa anomalies in winter

In the previous studies many researchers are focused on the geopotential distributions of persistent anomalies of the extratropical Northern Hemisphere wintertime circulation such as Dole (1978), Wallace and Gutzler (1981), Dole (1982), Dole and Gordon (1983), and Dole (1986a, b). Dole (1989) used observational analyses to identify systematic aspects of the life cycles of persistent anomalies of the extratropical Northern Hemisphere wintertime circulation. He focused on the typical characteristics of the 500 hPa height anomaly and flow patterns accompanying the development and breakdown of large-scale flow anomalies in two key regions, the eastern North Atlantic (ATL) and the northern Soviet Union (NSU). The positive anomaly and negative anomaly cases for a given region display a number of striking similarities. The primary anomaly centers develop rapidly, with little indication of a significant anomaly over the key region until just prior to onset. Following establishment of the major anomaly center over the key region, anomaly centers develop and intensify in sequence downstream, leading to the establishment of the persistent anomaly pattern. Some of the anomaly patterns strongly resemble certain prominent teleconnection patterns (e.g., the Eastern Atlantic and Pacific-North American teleconnection patterns). The associated flow patterns are often characterized synoptically by the development of either blocking patterns or anomalously intense zonal flows over the key regions. These analyses lead to suggest a number of typical characteristics in the evaluation of persistent anomaly patterns:

the three selected study cases were found from the Climate Diagnostics Center (CDC), USA.

The Anomalies methods are used in the present study. The anomaly ?' of the geopotential height of 500 hPa at a grid point in the North Hemisphere is defined as follows:

$$??? ? ? \bar{?} ; \qquad (1),$$

$$\bar{?} ? ? \sum_{i?1}^{N?50} ?_i \qquad (2)$$

Where ? is the geopotential height and $\bar{?}$ is the 50-year mean at the concerned location in wintertime. The anomaly at the Northern Atlantic and Siberia key points is denoted by $(?'_A)$ and, $(?'_S)$.

The above mentioned two key points are located on (55? N –40? W) and (55? N- 100? E) respectively. The North Hemisphere Oscillation Index (NHOI) is determined form the following relation;

$$NHOI ? ?'_A ? ?'_S \qquad (3)$$

Sea surface temperature SST in Pacific Ocean

Seasonal variations of SST in the equatorial east Pacific have drawn a large amount of attention because they are large compared to other tropical locations. They are dominated by the annual harmonic, they result from strong atmospheric ocean coupling and they are important for the evolution of interannual variations, Jin et al. (1994), Tziperman et al. (1994), and Jin (1996). The specific component of the dynamical circulation that drives SST variations depends on where in the pacific one considers, Chang (1994), and Kessler et al. (1998). Close to the South American coast, seasonal variations of meridional wind force upwelling of cool subsurface water, while farther to the west, easterly trade winds do the same. Kessler et al. (1998), in an ocean model study, found seasonal variations of surface radiative fluxes forced by cloud variability to be important to SSTs just north of the equator between 90? W and 120? W, with the influence of clouds decreasing to the south. Mitchell and Wallace (1992) determined that the seasonal cycle of meridional winds associated with seasonal varying convection in the ITCZ forces the seasonal cycle of SSTs in the equatorial cold tongue between 85? and 105 W. The seasonal cycle of SST in the east Pacific has maximum amplitude between the equator and 10 S. Temperatures are warmest when the prevailing northward meridional winds are at a seasonal minimum, and coolest when those winds are at a maximum. As mentioned by Mitchell and Wallace (1992), the seasonal cycle of meridional winds in the phase with that of diabatic heating in the ITCZ, as one might expect from the response of the atmospheric circulation to an idealized zonally uniform heat source, Gill (1982). Bergman and Hendon (2000) concluded that the clouds played an important role for seasonal variations in the Far East Pacific (85? – 105? W).

most of the North Pacific and reduced the precipitation rate above the cold SST anomaly that develops in the central Pacific. The composite geopotential height anomalies associated with changes in the North Pacific SSTs have an equivalent barotropic structure and range from -65 m to 50 m at the 200-mb level. Including air-sea feedback in the North Pacific tended to damp the atmospheric anomalies caused by the prescribed El Nino conditions in the tropical Pacific. As a result, the zonally elongated geopotential height anomalies over the West Pacific are reduced and shifted to the east.

Xiang et al. (1993) found that before June of an El Nino year, and after October of the next year, no extensive, sustained significant correlation appears in the entire Northern Hemisphere. From June to August of an El Nino year, however, small positive correlation areas are observed first at lower latitudes of the eastern and western hemispheres. Which gradually strengthen and expand starting in September. It changing into a positive correlation belt surrounding nearly the entire Northern Hemisphere by December of the El Nino year and lasting into March of the next year, then rapidly weakening from June to September of the next year. Thus, lower latitude atmospheric circulation is closely correlated with El Nino events, with the best positive correlation period lasting from winter of the El Nino year to spring of the next year.

The equatorial tropical Pacific climate system is a delicate coupled system in which winds driven by gradients of sea surface temperature (SST) within the basin interact with the ocean circulation to maintain SST gradients. These results in the time mean state having a strong zonal temperature contrast along the equator with an eastern cold tongue and a western warm pool. By the same coupled processes, interannual variability known as the El Nino-Southern Oscillation (ENSO), is present in the Pacific, Van der vaart et al. (2000). Parsons et al. (2000) found that dry air associated with a middle-latitude wave was able to reach equatorial waters and produce a noticeable impact on the atmospheric thermodynamics, cloud and radiative processes and the ocean surface. The present work aims to investigate the relationship between the Anomalies in 500 hPa geopotential height over the North Hemisphere in winter and the occurrence of El Nino events.

Data and Methodology

The data used in this study are 1200 UTC-monthly 500 hPa geopotential height 5? latitude X 5? longitude in the North Hemisphere in winter for 53 years in winter from 1 January 1946 through 31 December 1999. These data cover the Northern Hemisphere from 20? to 90? N. These data are NMC analyzed. It have been obtained from the National Center for Atmospheric Research (NCAR). The winter season consists of December, January and February months. The Sea Surface Temperature data , SST, of NINO 1+2 from latitude 0° to $10^{\circ} S$ and longitude from $90^{\circ} W$ to $80^{\circ} W$, and NINO 3+4 extended from latitude $5^{\circ} N$ to $5^{\circ} S$ and longitude from $160^{\circ} E$ to $90^{\circ} W$ from 1 January 1950 to 31 December 1999 were obtained from Climate and Global Dynamics Division (CGD) in NCAR. The Meteorological data for

ON THE RELATIONSHIP BETWEEN THE ANOMALIES IN 500-HPA GEOPOTENTIAL HEIGHT ON THE NORTHERN HEMISPHERIC WINTER AND EL NINO OCCURRENCE

Y. Y. Hafez and H.M. Hasanean

Astronomy and Meteorology Department, Faculty of Science, Cairo University, Giza, Egypt yhafez@sci-astro.cairo.eun.eg

ABSTRACT

A 50- year record of 500-hPa geopotential height fields from the NCDC and El Nino events during the period (1950-1999) are used to investigate the relationship between the anomaly of the pressure field over the Northern Hemisphere in winter and El Nino occurrence. We examine the teleconnection between El Nino, as climatic evidence, and the climatic fluctuation in the pressure in upper atmosphere in the Northern Hemisphere. In the present work, the winter season comprises the three months (December, January and February). We found that, air circulation at the equatorial region is influenced by the blocking of westerlies air current in the Northern Hemisphere. Also, the splitting in the upper westerly air current over the Northern Atlantic is more frequent with El Nino events in winter mainly during the last two decades. The results also show that the occurrence of El Nino is more sensitive to the geopotential height anomalies in the Northern Hemisphere in winter, in particular in the Northern Atlantic region and Siberia.

INTRODUCTION

There has been much interest in understanding the natural variability of the climate system in recent years. This is partly because of its direct socio-economic impacts, in the phenomena such as ENSO (El Nino- Southern Oscillation), and partly because of its implications for climate change detection. The El Nino- Southern Oscillation (ENSO) phenomenon is regarded as the most prominent climate signal in the tropics on interannual timescales, Philander (1990). It is characterized by sizable sea surface temperature (SST) anomalies in the central and eastern tropical Pacific and a see-saw involving opposite changes of surface pressures between Darwin and Tahiti. The influence of midlatitude air-sea interaction on the atmospheric anomalies associated with El Nino is investigated by coupling the Community Climate Model to a mixed-layer ocean model in the North Pacific, Alexander (1992). Prescribed El Nino conditions, warm sea surface temperatures (SST) in the tropical Pacific, cause a southward displacement and strengthening of the Aleutian Low. This results in enhanced (reduced) advection of cold Asian air over the west-central (northwest) Pacific and northward advection of warm air over the eastern Pacific. Allowing air-sea feedback in the North Pacific slightly modified the El Nino-induced near-surface wind, air temperature, and precipitation anomalies. The anomalous cyclonic circulation over the North Pacific is more concentric and shifted slightly to the east in the coupled simulations. Air-sea feedback also damped the air temperature anomalies over

Miller F. P., 1998. Soil-land degradation: Intervention for sustaining civilization, p. 13-32 in: Ratton Lal, Ed., 1998, "Soil Quality and Agricultural Sustainability", Ann Arbor Press, Michigan, 378 p.

Rognon P., 1989. Biographie d'un désert: *LE SAHARA*, 374 p. l'Harmattan, Paris. Ratton Lal, Ed., 1998.

Soil Quality and Agricultural Sustainability, Ann Arbor Press, Michigan, 378 p.

Scherr S. J., 1999. http://www.ifpri.org/2020/briefs/number58.htm

Shortt D., 2001. http://ssca.usask.ca/ISSUE15/COPYFILE/Ps2.htm

United Nations Conference on Environment and Development (UNCED), 1992. "Agenda 21". World Resources Institute, 2001. "Miscellaneous Publications".

CONSULTED WEB PAGES (January, 2001)

Web pages of
"Center for International Earth Science Information Network", Columbia University.
http://www.ciesin.org/TG/LU/degrad.html
http://www.ciesin.org/TG/LU/humanfac.html
http://www.ciesin.org/TG/LU/cost.html
http://www.ciesin.org/TG/LU/policy.html

Web page of the
"Pacific Northwest National Laboratory, USA".
http://etd.pnl.gov:2080/hydrogroup//capabilities.html#recharge

Web page of the
"International Soil Reference and Information Center (ISRC),
Global Assessment of the Status of Human-induced Soil Degradation (GLASOD)", USA.
http://www.isric.nl/GLASOD.htm

Web pages of the
"Food and Agriculture Organization, UN".
http://www.fao.org/inpho/vlibrary/u8480e/u8480e0d.htm
http://www.fao.org/inpho/vlibrary/u8480e/U8480E3z.jpg
http://www.fao.org/inpho/vlibrary/u8480e/U8480E0E.HTM

Web page of
"Center of Environmental Development for the Arab Region and Europe".
http://www.cedare.org.eg/software/soft4000.shtml

Other Web pages:
http://www.ncc.nsw.gov.au/environ/ecatch.htm
http://www.nhq.nrcs.usda.gov/WSR/Landdeg/papers.htm

The scheme presented in this work for controlling and monitoring land and water degradation is believed to introduce a preliminary feasible frame for partially supervising the problem in Egypt; it is easily expandable to Arab and African countries. The monitoring scheme has an open-structure core and free sub-divisions that can be enriched as needed. An implementation of this type of monitoring scheme on personal computers (to be published elsewhere) and its diffusion on the Intranets of the national agricultural extension services can be very pledging. However, the implementation of the intended effort requires the financial support of agricultural investors and/or governmental institutions.

REFERENCES

Arshad M. A., and Coen G. M., 1992. Characterization of soil quality: Physical and chemical criteria. Am. J. Altern. Agric. 7: 25-31.

Barrow, C. J., 1991. Land Degradation, Cambridge Univ. Press, Cambridge.

Blaikie and Brookfield, 1987. Land Degradation and Society. Cited in http://www.ciesin.org/TG/LU/degrad.html

Chisholm A. and R. Dumsday, Eds., 1987. Land Degradation, Cambridge Univ. Press, Cambridge.

Daily, G. C, 1995. http://dieoff.org/page114.htm

Dasgupta, P., 1993. An Inquiry into Well-being and Destitution, Clarendon, Oxford. Del Vall H. F, 1997. http://www.estec.esa.nl/conferences/veracruz97/Abstracts/H.html

Fahmy Hussein M, 2000. (Accepted). Recharge in northeastern Sinai using Chemical-isotope profile archive (*"CIMPA"*) of the unsaturated zone, in: Soil and Sustainable Agriculture in the New Century", Egyptian Soil Science Society Jubilee Conference, Cairo, December 2000.

Fahmy Hussein M, 1990. Hydrochimie, géochimie et géochimie isotopique et évolution des sols salés du delta du Nil. Thesis; Doctorat D'Etat ès Sceinces Naturelles, Paris University, Orsay, France.

Forse B., 1989. [New Sci. 1650, 31].

Kimble J. M., 1998. Minimum data set needed for soil and climate characterization. p. 44-50 in: Ratton Lal. Ed., 1998, "Soil Quality and Agricultural Sustainability", Ann Arbor Press, Michigan, 378 p.

Kishk M. A., 1999 (in Arabic). Soil and Water in Egypt. Merit for Publishing and Information, Cairo, 319 p.

Landmark A., 2000. http://www.hort.agri.umn.edu/h5015/99fpapers/landmark.htm.

Oldeman L. R., Hakkeling R. T. A., and Sombroek W. G., 1990. World Map of the Status of Human Induced Soil Degradation: An Explanatory Note, rev. (International Soil Reference and Information Center, Wageningen, Netherlands, rev. ed. 2)

Olson, 1981. Archeology: Lessons on Future Soil Use. Cited in http://www.ciesin.org/TG/LU/degrad.html

McC. Adams R., 1981. Heartland of Cities. University of Chicago Press, Chicago.

Maucbach M. J. and Seybold C., 1998. Assessement of soil quality, p. 33-44 in: Ratton Lal, Ed., 1998, "Soil Quality and Agricultural Sustainability", Ann Arbor Press, Michigan, 378 p.

CONCLUSIONS

Land and water degradation is one of the most important policy and research issues on the agenda of the 21st century. Without a close knowledge on the extent to which this multi-facetted environmental problem is expanding world- and nationwide, grave socioeconomic and political impacts will soon seriously menace the quality of the human life on the globe, in particular for the poor populations in the third-world countries. With the present-day rates of land and water deterioration, this environmental problem will at least create irreversible situations on the level of natural resources management everywhere and/or slow-down the mundane economic exchange rates due to shortage of agricultural benefits from arable lands.

For the irrigated lands used in agricultural production under the unfavorable conditions of the arid and semi-arid zone, in particular under the evil dominance of poverty in the third-world countries, the physico-biological situation is two-fold problematic. Not only non-renewable lands will deteriorate, but also the limited surface water and the fossil groundwater are subject to somber impacts through pollution and depletion, respectively, to the horizon of the year 2050. Rapid worldwide and national actions are urgently needed to alleviate this dark scene. In front of the human activities implemented to stop the process, and to potentially reverse its direction, comes monitoring procedures that are apt to transform our irregular information into organized sets of knowledge. Coherent datum levels could be used for following-up the situation on the long run. Poor start will unavoidably lead to misleading conclusions and meager solutions within time and space. The present-day available information on the size and global distribution of the problem nationwide is not satisfactory. It needs strong rectification through regular and standardized land quality monitoring programs.

In Egypt, the lack of cooperation between the land, water and environmental authorities and the research centers including universities is no more acceptable. Consistent cooperation must promptly be activated and entirely re-formulated as geographically and temporally required to ensure the best results. Soil and water specialists have to introduce suitable sets of criteria for judging soil characteristics and processes. Also, water parameters as well as the environmental processes related to land and water quality assessment should be addressed in the same package. These criteria should take into consideration the relationship between the agricultural inputs and outputs (including production diversity and the socioeconomic targets) along with the implementation of flexible criteria and readjustment procedures according to the historical and future land use type. Land and water protection trust funds must be established in order to support partnership of the state with farmers and investors. The state and/or international agencies may cover this trust fund. Land and water quality identification databases (resulting from the monitoring programs) should be diffused to the public, and the results of the national inventory program must be catalogued on the district, landowner and village levels. On the national level, representative information could be diffused on the Internet (or on Intranets with limited access for specialists).

Monitoring Scheme for Quality of Land and Water

(Brief Core - see annexed PC spreadsheet)

Province Level

- **RSWD**
- **SIS**

Village Level

- **LQIF**
- **LQIC_IF** containing LQP (same as the Farm Level)

Farm (or Landowner) Level

- **LQIC** containing LQP
  - **In Old Lands**
    - **Properties**
      - Texture – Structure – N P K +
      - Internal drainage conditions
      - Productivity – *"Numerical"*(*)
    - **Processes**
      - Water-logging and Reduction
      - Salinization/Sodicity – Clay Hardpan
      - Pollution – Improvement history
    - **Land-use**
      - Field crops – Horticulture
    - **Water supply**
      - Water salinity – Field drainage
  - **In New Lands**
    - **Properties**
      - Texture – Carbonate – N P K +
      - Productivity – *"Numerical"*(*)
    - **Processes**
      - Water-logging – Salinization
      - Carbonate Hardpan – Pollution
      - Reclamation history
    - **Land-use**
      - Field crops – Horticulture – variable
    - **Irrigation method**
      - Flood – Sprinklers – Pivot – Drip
    - **Water supply**
      - Water salinity – Groundwater shortage

(*) The term *"Numerical"* mentioned-above is a "categorization examination value" assigned for land quality in a spreadsheet prototype model (for Microsoft Excel®) based on soil profile and site characteristics. This spreadsheet is an integral part of the present work. It is available from the author upon written request or by e-mail (address: fahmy@link.net). The present preliminary version of the model adopts a simple assessment approach based on a set of arbitrary values and weights assigned to the used criteria. Since the major problem in attributing a unique grading value for any given soil is obviously the absence of reference datum, the arbitrary assignment of values is the method adopted in the model referring to a local reference highly productive field. However, this fundamental approach requires further in-depth evaluation. Also, the approach must be enhanced by a set of numerical attributes for soil and water chemical and physical analytical data and soil processes. The "final" scheme will be presented elsewhere as a detailed computer spreadsheet model for monitoring the quality of land and water on the "landowner level".

evaluation of vertical water flow and solute transport in parts of representative fields. Such observations should be processed using adequate hydrological modeling software packages to follow groundwater recharge and groundwater quality.

6. For the surface water open channel network systems (irrigation canal and drains) and lakes in each province, a regional center (including laboratories and communication equipment) for chemical, biological, hydraulic, hydrologic information and data processing should be established. Information dissipation among the local population could be helpful in creating awareness about water resources quality in the concerned region. The same centers could be charged with following-up the groundwater quality as well when it is used for providing complementary irrigation and drinking water.

(LQIC_IF) should be ensued once over five years in order to report the possible changes that can take place in land quality.

3. The list of "Land Quality Parameters (LQP)" in the LQIC and the LQIC_IF should be aware of specific criteria related to the regional geography and to land-use history of each region. Two major categories of land use and history of land-use are well known in Egypt. These are the "old cultivated lands" category (in the Nile floodplain and delta), and the "newly cultivated lands" category (in open desert and the desert/flood-plain fringes). However, under each category there is a wide range of soils under different conditions. Sub-division units could be identified as following:

   i) Under the "Old Lands", sub-divisions could be recognized due to difference in:soil properties (texture, structure, drainage conditions, and "numerical examnation"*), the dominant soil processes (water-logging, salinization/sodicity, clay hardpans, pollution and improvement projects already carried out), the type of land-use (field-crop *versus* horticulture production) and conditions of water supply and discharge (water quality and field drainage problems).

   ii) Under the "New Lands", sub-division units are admitted due to differences in: soil properties (texture, solid-phase carbonate content), contrast in soil processes (water-logging, salinization, carbonate hardpan, pollution/ reclamation history), diversity in land-use (field-crop *versus* horticulture production), variation in irrigation method (flood, sprinkling, pivot, drip), and conditions of irrigation water supply and discharge (water quality and groundwater shortage problems).

4. A list of "Land Quality Defaults LQD" could be defined for selected areas in each sub-divide unit. It must be adequately selected in order to report to the major soil defaults, actual and potential management problems in the selected area. The follow-up of the (LQD) could show the negative (and positive) shifts that could take place in the nearest Indicator Fields (whose set of values could be referred as reference).

5. For the known difficulty of studying the composition of the natural soil solution in field soils, two alternatives are proposed:

   i) In soils with shallow phreatic water-table, a "time-series follow-up of the water-table chemistry" should be scheduled for dual checks per year. These soil water-table chemistry serial checks should be related to the chemical study of the local groundwater since the upper water-table is the unique source of possible groundwater degradation through the unsaturated flow across soils. Automated lyseimeters could be used in representative fields in order to follow the on-field water and solute balance.

   ii) In soils with deep unsaturated zone, automated lysimeters experiments should be carried out for obtaining a detailed time-series

- Developing physical and institutional barriers to protect farmland from urban soil pollutants,

5. Rainfed lands

Policy:
- Integrating technology development and agricultural extension,
- Improving good soil husbandry and agrochemical management,
- Improving agricultural machinery use,
- Developing market-based mechanisms,
- Improving distribution systems for fertilizers that reduce cost,
- Improving nutrient balance,
- Encouraging complementary use of organic nutrients,
- Changing conventional farming practices to others with low disturbance seeding,

Research:

- Developing recommendations and technologies for fertilizer and organic nutrient management for specific soils, climates, and crops,
- Identifying or developing low-cost organic nutrient sources for small holder producers,
- Designing biotechnologies and other technical advances for integration into sustainable resource management systems,
- Carrying out research for the estimation of recharge groundwater to coastal aquifers and following marine groundwater intrusion,
- Undertaking research for seawater deslination in coastal areas,

b) Specific Scheme for Egypt

To the above-mentioned general policy and research items, we propose the following scheme for the control of land and water deterioration and for monitoring land degradation in Egypt:

1. The establishment of a "Regional Soil and Water Database (RSWD)" and a "Soil Information System for Degradation Control (SIS-DC)", in each province. These data should be transmittable (in simplified forms) to the framers' associantions and investors through the agricultural extension services in order get them involved in the control of water resources and the development of their own lands. Each landowner should obtain a detailed "Land Quality Identification Card (LQIC)" for his farm, and the information reported in this card must be updated at least once over five years.

2. The concerned authorities, in collaboration with selected landowners, could select specific "Land Quality Indicator Fields" (LQIF) in each village. The LQIF could be used as permanent "checkpoints" for the following-up land quality in each region on a time-series basis. In these checkpoint fields, the state of the LQIC of the Identification Card

2. Densely populated low-quality lands

Policy:

- Improving soil quality and management,
- Increasing nutrient inputs, and improving nutrients-use efficiency,
- Increasing organic matter content in the root zone,
- Helping farmers to organize and finance investment in land improvements,

Research:

- Developing low-cost soil rehabilitation techniques,
- Developing nutrient management systems for specific soils,
- Finding low-cost sources of plant nutrients,
- Developing economical methods for incorporating more perennial plants on farmlands,
- Developing profitable systems to manage local forest and grazing lands,
- Documenting and sharing the more effective soil management practices,

3. Marginal lands:

Policy:

- Limiting the environmental damage of farming practices at a minimal cost to farmers,
- Helping farmers make the transition to more sustainable systems,
- Raising the value of forest and tree products to reduce land clearing,

Research:

- Developing technologies for low-input farming,
- Developing higher-value products that encourage spatial concentration of production,
- Instituting crop, forest, or range management systems that will meet both local economic and broader environmental objectives,

4. Land around urban zones

Policy:

- Controlling agricultural land conversion,
- Regulation of agrochemical and livestock waste disposal,

Research:

- Designing technologies to improve the use of urban waste products in soil nutrient management and livestock feed,
- Minimizing toxic agrochemical use,

After Scherr (1999), Landmark (2000), Shortt (2001), and other Web sites (like http://www.ncc.nsw.gov.au/environ/ecatch.htm), and after modifications by the present author, the following policy actions and research priorities are proposed for land degradation control. Since there is no standard classification for land and water degradation and their environmental impact (http://www.cedare.org.eg/software/soft4000.shtml), the following five categories are classified according to an optional conceptual basis related to the nature of land resources, the biological life, and the socioeconomic/political reaction. Nonetheless, the solution of the problem would not be through introducing oversimplified approaches like that used in the "Environmental Impact Assessment Decision Support System EIADSS" for Irrigation Projects" (http://www.cedare.org.eg/software/soft4000.shtml). EIADSS is merely a computerized checklist for irrigation decision making that does not treat the complex interrelationships between parameters. In fact, much better approaches are needed.

a) General Policy and Research Scheme

The following general scheme deals with priorities in policy and research in five cases:

1. Irrigated lands

Policy:

- Improving system- and farm-level water management regimes,
- Investing in proper drainage systems,
- Retire lands that are irreversibly degrading with minimal disruption to farm communities,
- Use of crop residues (e.g. corn, soybeans and sugar beets) and clean industrial by-products (e.g. papersmill compost, cardboard and food processing residues), instead of municipal sewage, in order to increase organic matter content,
- Improvement of soil nitrogen balance, reducing nitrogen loss by nitrate leaching,
- Immobilization of toxic metals, filtration of pesticides,
- Lowering soil pH and ESP and increase infiltration rate,
- Ensure sustainable management of stream-banks, riverbanks and wetland margins to
- Minimizing erosion, and preserve and enhance habitat values,
- Stabilization, maintenance and enhancement of coastal landforms,
- Developing trust funds for clean water management,

Research:

- Exploring problems of micro-nutrient depletion,
- Exploring soil-related factors that may lead to yield stagnation,
- Identifying effective water-management regimes,
- Developing low-cost methods to control or reverse salinization,
- Finding alternative uses for highly saline lands,

Also, the river and canal banks and wet margins should be considered for specific management corresponding to their shallow water-table conditions. In all case, the shallow water-table problem should be addressed in a coherent manner using planned groundwater pumping for irrigation instead of the present tendency to amplify the reuse of polluted drainage water. Programs of soil salinity and pollution control should be enhanced through the introduction of suitable computer packages that can be run by trained staff on the regional scale.

Local population needs to be informed on some simple principals of water flow and solute transport in soils using adequate video films that show, in a clear manner, the efforts needed, and the parameters required, for understanding the conditions of the lands by the concerned authorities. Also, simple maps of soil quality could be displayed in order to make the farmers aware of the present status of their lands and the possible and impossible interventions that can be undertaken to improve them. During the process of land price evaluation for transactions, the rural population could progressively be provided with registers of land conditions identification card as a coherent reference and guide. Local schools could be used as channels for information dissipation. Schools can also be used to acquaint landowners about the penalties previewed by the law for intended land degradation practices and to encourage the involvement of the rural community in land care and cure projects. Land and water conservation departments should conjugate their efforts in one local package, otherwise the local community will loss confidence in the concerned authorities. The Egyptian Environmental Affairs Authority (EEAA) should be involved with the Ministry of Agriculture and the Ministry of Water Resources for the realization of local common goals. For example, the unplanned installation of septic tanks in villages, the management of urban wastewater in small rural cities and the over use of agrochemicals are direct fields for this type of cooperation.

THE PROPOSED SCHEMES

From an agricultural point of view, land degradation may essentially and practically be understood as the net decrease of soil potential to support optimal plant growth due to changes that have taken place in the soil environment with or without impacts from the human activities. This reduction of soil capacity gives rise to a continuous and general diminution of productivity. In a broad sense, soil degradation weakens its resilience, threatens the sustainability of its productive role and opens the way for desertification. In fact, when land degradation reaches a point of non-return in the arid, semiarid and sub-humid areas, soil ultimately becomes out of agricultural use and the situation is known as desertification (http://www.ciesin.org/TG/LU/degrad.html). These areas represent more than 40% of the world lands. The priority in combating desertification should be the implementation of preventive measures for lands not yet degraded (http://www.ciesin.org/TG/LU/policy.html). As the old wisdom says: "Prevention is better (and cheaper!) than cure."

soil and water resources could reduce land degradation, help to build-up soil resilience and enhance rehabilitation, while poor management will amplify degradation.

The physical and hydraulic characteristics of the vadose zone dampen the flux of water and solute transmission downward. Consequently, the transport of contaminants (such as fertilizers, pesticides, herbicides, and industrial chemicals) is attenuated by simply delaying and/or by decaying through chemical and biological processes. Recharge rate (responsible of aquifer replenishment) can be used to predict when contaminants will reach the water-table (http://etd.pnl.gov:2080/hydrogroup//capabilities.html#recharge).

b) Mitigation of biophysical and socioeconomic aspects

Institution of specific strategies for sustainable land development is also a preliminary prerequisite for land degradation control. This needs the establishment of a specific administrative service of land degradation survey on the national and regional scale and the implementation of a specific database and digital cartographic methods. Also modern methods of information communication between the local and regional administration is urgently needed. In the case of Egypt the currently present services provided by the Ministry of Agriculture (the Agricultural Research Center "ARC" and the General Authority of land Improvement "GALD") could be a good starting point. However, the predefined goals of these institutions should be reworked in order to accommodate for the holistic issue of land degradation control and its new aspects, including other components of the natural ecosystem. More important in the development of these institutions is the introduction of new facilities and logistic support that correspond to the new tasks. Communication of data and decisions among the national headquarter and the regional centers should be reconsidered in order to be shifted to the use of computer networks and data automation. Also, data and concept transmission to the concerned populations should be reactivated through a solid modernization of the agricultural extension services in each province. The new guidelines for the extension services could include an active transmission of information and providing advise to farmers and landholders with specific recommendations concerning land use limitations and future perspective for land use change. This activation would enhance the coordination between authorities and the local communities and guarantee success when the people involved in land management are not discarded by the authorities. Also, illegal land use should be put under control through creation of mutual understanding.

As the alluvial soils of Egypt support the life of two thirds of its population, a national planning for developing the villages and the small towns is a very critical issue that has to be implemented on a modern long-term basis. Also, a critic change in the pattern of agricultural production in the suburban zones should be developed to accommodate for the specific and products the urban zones require. Moreover, lands in the suburban zones can be saved from degradation by the generalization of greenhouses and tunnels. Large rural areas have to receive special care in terms of agglomeration of small land holdings into larger farms that produce the same crop in order to admit mechanization.

regional evaluation of the advancement, or regression, of the phenomenon. Because soils are dynamic systems (continuously affected by climatic, hydrologic and biological activity that can – under improper management – drive soil degradation), the quantification of soil quality must be transacted in "currencies" related to "processes" rather than "properties" (Miller, 1998). Maucbach and Seybold (1998) discussed the indicators and reference values that can be used for indexing soil quality. The standard set of measurable soil quality indicators (selected to reflect the capacity of soil to function) must be sensitive enough to detect changes in soil as a result of degradation (Arshad and Coen, 1992). Meanwhile, Kimble (1998) argued the possibility of referring to a minimum data set for soil quality assessment, and recommended that its selection must take into consideration site conditions and ultimate customer needs.

One of the major problems of monitoring land degradation as resulting from some conventional farming practices is that soil degradation process is slow enough to be observed on man's life time-scale (Shortt, 2001). Consequently, more appropriate criteria of "measuring" land degradation is needed and comparative studies is required to show to what extent the process has taken place with reference to certain "datum levels".

Application of Control and Rehabilitation

a) Defining the present situation is a pre-requisite

The major step in any procedure that tackles the land degradation problem in any particular region resides in the recognition of the extent to which the problem spread has reached and spatial distribution over the concerned area. An assessment of temporal changes that can take place in the severity level of the problem is also needed. Both can be done through systematic investigation and programmed plan of research and routine investigation. Mapping degraded soil and using a specific Soil Information System (SIS), based on the principals of (GIS), is needed in order to facilitate dealing with the huge amount of information that will be collected. The physical and chemical aspects used in the categorization of land and water degradation on the regional scale requires the establishment of a national program for land degradation control. Modeling of degradation that can take place *via* water-transported chemicals in soil is a very helpful domain of research that obviously can enhance our understanding of the problem and elaborate its remedy. Implementation of clear restoration measures can also be followed-up through model predictions.

Rationalization of the social demand on the irrigated soils, placing more cultivated lands under clean biological farming and reducing the agricultural stresses to which water resources are subjected are among the necessary measures that should participate in significantly stabilizing and controlling land degradation and/or lowering its rate. Also, preventive measures should be undertaken for lands that are not yet touched by degradation. Laws dealing with the environmental protection should be implemented in order to stop more land and water degradation on the national level. Briefly, wise management of

5. Non-adjustment of soil pH and non-application of adequate sources of organic matter,
6. Non-generalization of environment-friendly procedures for nitrogen fixation and farm waste management,

Social Aspects

Before any global agreement on "limits" (that can be used for the determination of land deterioration) can be forwarded, it must be born in mind that a relativistic aspect is inherent in the idea of judging degradation. The relative social importance of soil productivity can hardly be separated from the general targets defined for the agricultural wealth in the society and the state economy, and cannot be isolated from the level of the social prosperity of the region or the state. Chisholm and Dumsday (1987) discuss society's role in degrading land. Also, society has a major role in soil degradation through the applied agricultural policies and practices and through water management on the national scale. This role comprises poor soil management, application of defective technology, overpopulation, sever economic deficiency, and the decisions made by the social and political institutions and officials. Soil degradation and poverty go had-in-hand because degradation is driven by the strong interaction between biophysical and socioeconomic factors (Ratton Lal, Ed., 1998).

Several human factors (http://www.ciesin.org/TG/LU/humanfac.html) are associated with land degradation; including poor land management, inadequate technology, overpopulation, poverty, and decisions of social and political structures. It is difficult to estimate the costs of land degradation (http://www.ciesin.org/TG/LU/cost.html) due to the large number of factors contributing to degradation (some of which are difficult to assess), and because economic losses are often gradual and cumulative. (Scherr, 1999) mentioned that the poor people often lack the capacity to make land-improving investments, so, they tend to suffer from soil degradation more than the rich people. Also, she mentioned that "land degradation is sometimes a result of poverty". "Poor farmers, with no resources to fall back on, may be forced to put immediate needs before the long-term health of the land." Governments, under pressure from foreign debt and the needs of population, often fail to give adequate support to rural people (http://www.fao.org/inpho/vlibrary/u8480e/u8480e0d.htm).

Monitoring

The monitoring effort done by GLASOD and other international agencies (including the UNEP) is based on the incomplete existing knowledge. Consequently, more detailed assessments of soil degradation, are needed at the national level. In fact, the geographic distribution of degraded lands and the severity of degradation is still poorly documented (Forse, 1989). So, one of the challenging aspects of land degradation is related to the monitoring of the geographic distribution problem. Site monitoring could be feasible while regional monitoring is less obvious. Consequently, mapping deteriorated soils is a continuous process that should be followed-up to report a national and/or

Management, planning and study problems:

1. Application of flood irrigation without appropriate drainage (whereas modern irrigation methods should introduced or good drainage schemes should be applied),
2. Ignoring the minor differences in soil properties across the area of new large farms.
3. Ignoring the nature of lithological composition of the soil profile within and below the root-zone in the newly cultivated lands,
4. Ignoring the scientific approach in land management and study (e.g. non follow-up of the cumulative effect of the applied agrochemical compounds, non-use of numerical models for water transport and solute water migration in the saturated zone, and the non-use of automated lysimeters for monitoring soil solution chemistry in research stations),
5. Uncontrolled urban expansion in the rural areas, shift from the agricultural use to other soil uses, removal of topsoil and the change of the natural slope (whereas it should be, as far as possible, maintained, in particular during land reclamation projects),
6. Removal of all vegetal residues of the harvested crops,
7. Introduction of weed and pests through sediment and animal compost transport from old farms to new farms, and through poor organic composites,
8. Accumulation of uncontrolled excavation sediments along the banks of canals and drains (whereas these materials should be transported to lowlands),

Hydrological and water application-related problems:

1. Ignoring soil hydraulic parameters when introducing the modern irrigation schedules and irrigation automation.
2. Ignoring the interaction with the shallow water table (when present) and the local groundwater aquifer on the long-run,
3. Application of flood irrigation in light-textured soils in the desert fringes of the Nile delta and valley,
4. Poor installation and/or follow-up of tile drains on the field scale and municipal waste-water problems in rural areas,
5. None-pumping from aquifers subject to groundwater over-recharge,
6. Non-generalization of conjunctive use of surface and water resources,

Chemical problems:

1. Use of excessive rates of agrochemical materials (insecticides and pesticides),
2. Application of untreated wastewater in irrigation,
3. Addition of fertilizers without a close study and follow-up of crop needs and soil fertility balance,
4. Application of commercial fertilizers without referring to a coherent knowledge of its source and chemical composition,

Figure 6 shows pie diagrams that represent the occurrence of degraded lands by distribution and type in the six continents, which are largely different in area. Erosion by water and wind, by far, is the most important factor of land degradation in all continents whereas chemical degradation is strikingly more widespread (in terms of area of degraded lands) in Asia and Africa than in Europe and the two Americas. On the contrary, in terms of percentage of the total area of any given continent, chemical degradation is higher in South and Central America than in Asia and Africa (Figure 3). Human-induced soil degradation is projected in Figure 7 from low to very high severity (excluding stable terrain made-up of ice cap, unused wasteland and deserts).

What are the criteria and limits used to consider land as degraded? No generally accepted set of criteria is known for replying this question. Each of the given types of land degradation imposes certain criteria and limits. Soils with natural poor quality have more susceptibility to degradation (Ratton Lal, Ed., 1998). It is believed that annual crops generally degrade soils more than perennial crops (Scherr, 1999) and common property lands generally suffer greater degradation than privately managed land. GLASOD (Global Assessment of Soil Degradation) of the ISIRC (International Soil Reference and Information Center) has introduced a specific way for estimating global soil degradation. Classification and preparing an inventory for land degradation according to the severity of deterioration is an ultimate purpose of the systematic study of the problem on any regional scale. An economic analysis of land rehabilitation and an orientation of land-use form usually accompany that inventory.

Features of land degradations are:

- Landslip
- Erosion of continental and coastal lands
- Increase of soil salinity
- Harmful weed spread
- Soil contamination from agricultural, industrial, urban and septic origins
- Specific land form loss such as:
    - Small islands in river coarse, river levees,
    - Submersion under lake and floodwater,
    - Overburden by aeolian sands,
    - Loss of surface soil layers used in brick fabrication,
    - Loss of wetland refuges used by certain plant and animal communities,
    - Infection by transmittable diseases).

Land and Water Degradation in Egypt

We believe that the one or more of the following set of 20 poor practices would lead to degradation of the cultivated lands and deterioration of water resources in Egypt:

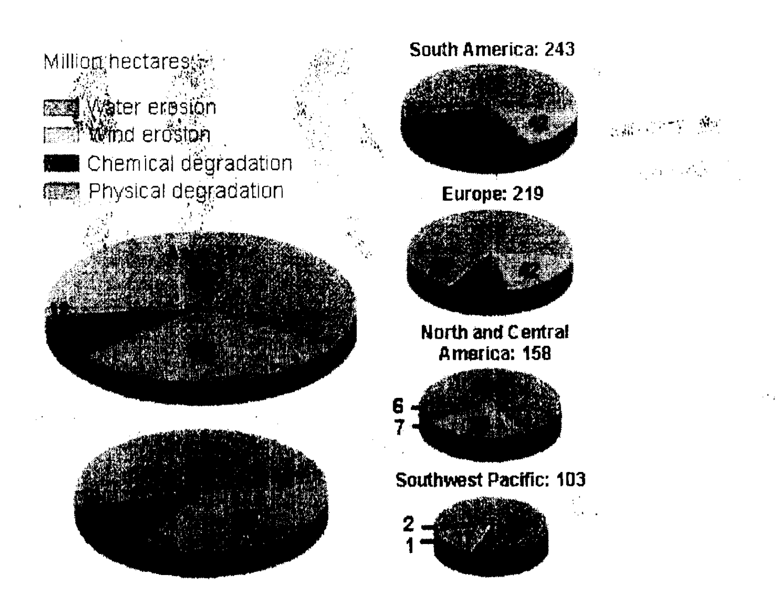


Figure 6. Distribution of soil degradation by area and type
Source: http://www.fao.org/inpho/vlibrary/u8480e/u8480e0d.htm

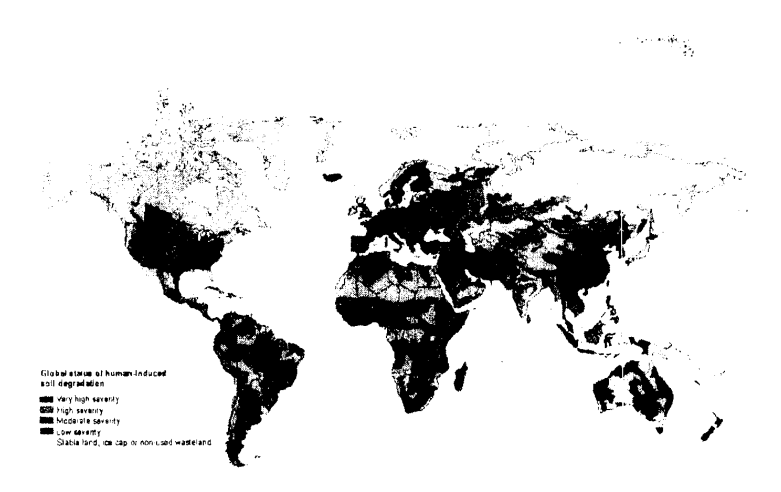


Figure 7. Global severity levels map of human-induced soil degradation
Source: http://www.fao.org/inpho/vlibrary/u8480e/U8480E3z.jpg

Types, Features and Poor Practices

The types of degradation are generally subdivided into erosion (either by wind or by water), the physical deterioration and the chemical decline.

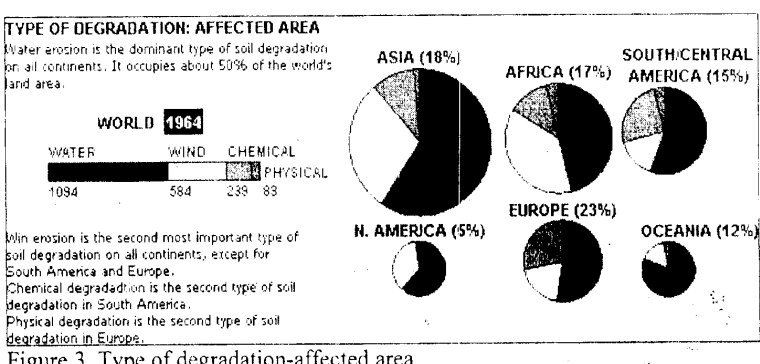


Figure 3. Type of degradation-affected area

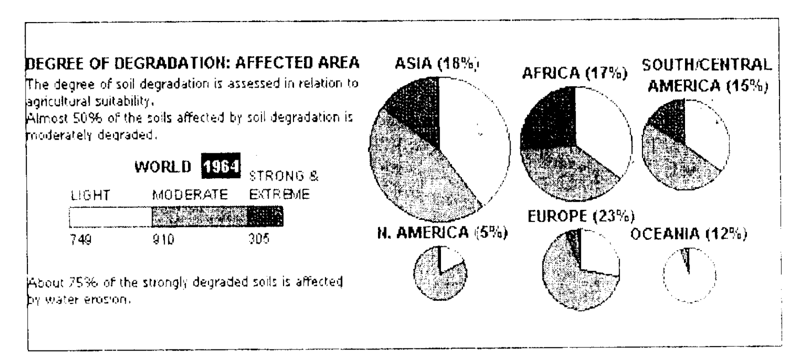
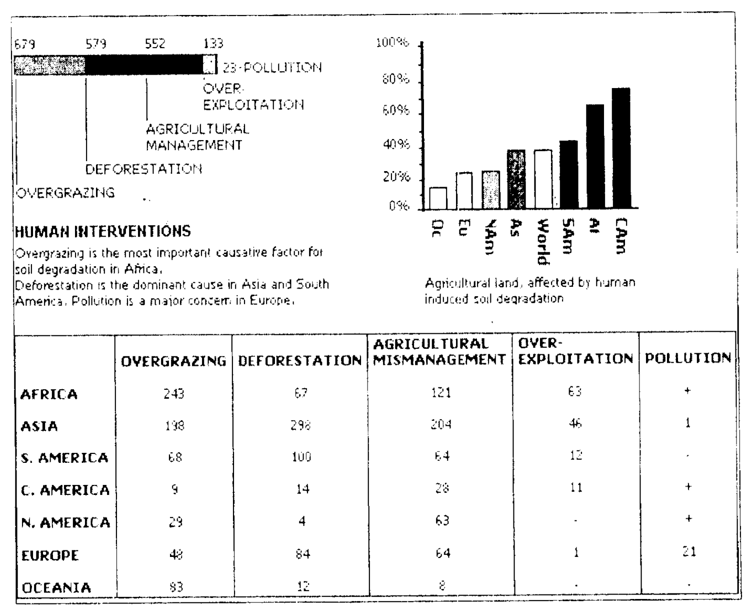


Figure 4. Degree of degradation-affected area



	OVERGRAZING	DEFORESTATION	AGRICULTURAL MISMANAGEMENT	OVER-EXPLOITATION	POLLUTION
AFRICA	243	67	121	63	+
ASIA	198	298	204	46	1
S. AMERICA	68	100	64	12	-
C. AMERICA	9	14	28	11	+
N. AMERICA	29	4	63	-	+
EUROPE	48	84	64	1	21
OCEANIA	83	12	8	-	-

Figure 5. Distribution of human-induced land degredation
Source of Fig 3, 4 and 5: http://www.isric.nl/GLASOD.htm

Added to the multiple causes of land degradation phenomenon, weighing the contributions of the different sources is challenging.

Time is an important aspect in soil degradation since the process is usually slow and accumulates on the long run. Also, the spatial distribution of degradation is an important aspect since the chemical damage has a net impact not only on the immediately affected fields but also on the neighboring environment *via* water circulation. Thus, the quality of surface water could ultimately be affected by outflow from irrigated fields, and finally contaminants are transmitted to adjacent and/or far-sited fields *via* the reuse of drainage water. Also, groundwater stored in the underlying leaky or unconfined reservoirs could be affected through vertical transfer of contaminants and pollutants downward. Under these conditions, we do not talk only about soil problems but also about extensive environmental problems that cover soils, surface water system and groundwater resources, where this last is partially used in drinking in rural areas.

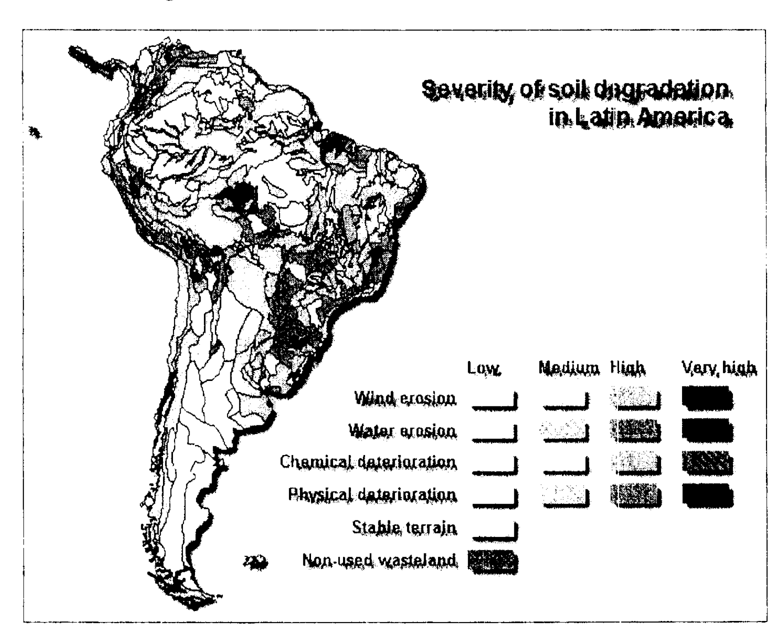


Figure 2. Soil degradation severity in South America
Source: http://www.isric.nl/GLASOD.htm

excavation, and the application of pesticides and insecticides is subject to recent environmental regulations. However, the above-mentioned study omitted the potential impact of the new massive introduction of drainage water recycling and the use of municipal wastewater in irrigation in the "old lands." In both cases, water charged with pollutants is introduced into soil and contaminants reach surface water channels and could reach the underneath local aquifers. In general, pollution is still the factor that contribute the less to soil degradation in Africa compared Europe (Figure 5). In Egypt, some point pollution cases are fairly documented, but non-point (agricultural) pollution is not. This shortage is obviously against the declared national intention of encouraging exportation of agricultural commodities to Europe, where markets are too exigent and sensitive to all kinds of pollution.

In the semi-arid and arid lands, wind erosion and overgrazing are the major causes of land deterioration due to sever and durable drought. During the recent drought that has taken place in the Sahel region in the 1980s, the Sahara was believed to expand southward by several latitudes due to man-made impact. However, the close study of problem showed that the phenomenon is mostly a part of a natural meteorological origin (Rognon 1989). For this reason, climate change became a major issue in recent studies. It is believed that the alternation of major drought and relatively humid cycles are preserved in the composition of the relict moisture contents of the deep unsaturated zones of the coastal deserts (Fahmy Hussein, 2000).

The chemical deterioration of soil environment is related to the whole set of the physical characteristics controlling soil moisture flow, and is also affiliated to the geochemical aspects governing the transport of dissolved constituents in soil. Thus, water quality and the management of water resources are of particular importance, especially under the irrigated agriculture in the arid zone, where water balance is deficient. Soil salinization is considered as a major mechanism of land degradation under the conditions of irrigated agriculture. Despite the net difference in the chemical composition of saline water of continental origin and marine salinity, soil salinity due to old seawater transgression is sometimes misinterpreted as being initiated by recent poor water management. The application of environmental isotopes in surface water, soil, and groundwater studies has resolved this problem (Fahmy Hussein, 1990). Recently, the excessive use of agrochemical and the spread of industrial and urban pollution have added new dimensions to the land degradation issue. Isotope, tracers, and modeling studies are urgently needed for understanding much of the inherent mechanisms of pollutant transfer.

If the hydrological system of the irrigated land has a complicated network of irrigation canals, drainage network, recycling of drainage water, natural aquifer recharge, and groundwater pumping, solute and pollutant circulation in the ecosystem become closely related to land deterioration. This complex situation is best studied by isotope techniques and modeling, and by the use of automated large lysimeters. By recycling drainage water in irrigation, more stresses are definitely introduced into soil environment, in particular when drains receive high loads of agrochemical amendments from intensively cultivated lands and pollutants from urban and industrial effluents.

quality lands. The greatest problems will probably multiply in the densely populated marginal lands of Sub-Saharan Africa and Asia, especially where markets are less developed and industrial inputs expensive. The 57 developing countries (with high population pressure on the land, and only $1x10^6$ to $10x10^6$ hectares of arable land) and the 38 developing countries (with less than $1x10^6$ hectares) need to develop long-term programs to protect and enhance the quality of their vulnerable lands. Egypt comes in the first group.

Causes

Land degradation can occur due to soil misuse and/or overuse through agricultural activities, urban settlement, tourism, infrastructure development and mining. Reasons of land degradation comprise deforestation, abusive exploitation, and depletion of nutrients, overgrazing, conversion of rural area by urbanization, implementation of poor irrigation and drainage schemes, poor surface and groundwater management, pollution by industrial activities and agrochemicals, and other stresses. In fact, land degradation results from an intricate nexus of social, economic, cultural, political, and biophysical forces operating across a broad spectrum of time and spatial scale (Chisholm and Dumsday, Eds., 1987, Barrow, 1991 and Dasgupta, 1993). Estimates of the relative importance of each cause of soil of degradation are overgrazing (35%), deforestation (30%), other agricultural activities (28%), overexploitation for fuel wood (7%), and bio-industrial activities (1%) (UNEP report by Oldeman et. al, 1990). Figure 2 shows the share of the human-induced soil degradation (compared to the natural factors and their degrees of severity) in South America, whereas Figure 3 shows percentage of different causes of land degradation in each continent. The severity of soil degradation differs greatly among continents (Figure 4) with Africa having the highest percentage of strong and extreme land degradation.

In irrigated lands, deforestation and overgrazing are excluded while overexploitation and the stresses of the agricultural and human activities are the major causes of land degradation in the form of salinization and destruction of soil structure. Kishk (1999) has outlined the major land and water management in Egypt. He clearly indicated that the information available has a great deal of inconsistency and contradiction. However, he referred to water-logging and high soil salinity (but no detailed maps are available to account for different degrees of salinization), poor follow-up of drainage projects (even in the new tile-drained areas), poor contract engineering works, and low capacity of governmental services. He also included the lowered soil fertility (due to high costs of fertilizers, the non-respect of nutrients balance and the non-existence of monitoring), the application of highly intensive agricultural practices on a very limited arable land area, and lack of analytical laboratories.

Kishk (1999) added that the change of land use to sub-urban activities (including excavation of topsoil to manufacture brick) has introduced land losses almost equivalent to the area reclaimed in desert during the last 50 years in Egypt. Also new aspects of land degradation in Egypt have recently been manifested as industrial (point) pollution and agricultural (non-point) pollution by agrochemicals and heavy metals. Since about 10 years, law forbids topsoil

details recommendations for action at national, regional, and international levels.

In1995,FAO (http://www.fao.org/inpho/vlibrary/u8480e/U8480E0E.HTM) has estimated, for 2010, that net cereal import requirements will significantly increase (primarily as a result of shortages of arable land). The increase will be from $8x10^6$ tons to $19x10^6$ tons for sub-Saharan Africa (+237.5%); $38x10^6$ to $71x10^6$ tons for the Near East and North Africa (+168.8%); $27x10^6$ to $35x10^6$ tons for East Asia (excluding China) (+129.6%); and $5x10^6$ to $10x10^6$ tons for South Asia (+100%). In 1997, more than 100 countries have signed the Convention to Combat Desertification (CCD). A key point of the CCD deals with scientific and technical cooperation on investigation, collection and evaluation of the processes involved in land degradation (http://www.nhq.nrcs.usda.gov/WSR/Landdeg/papers.htm). However, the effects of soil degradation on the environment and longer-term national wealth in soil resources have not been studied adequately, but are likely to add considerably to the economic impact (Scherr, 1999).

Origin and Scope

The earth could, in theory, feed very many more people than now inhabit the globe. But good soils, favorable climates, rainfall and fresh water are unevenly spread around the world - and do not necessarily correspond to distribution of population. So while some countries can produce an excess of food, others struggle with inadequate resources. Many developing countries are overexploiting their soils and several obtain food from land poorly suited to agricultural (http://www.fao.org/inpho/vlibrary/u8480e/U8480E0E.HTM). This means that soil degradation progress is a severe global issue.

There are several dominant processes responsible for land degradation. Ratton Lal (1998) cited erosion, depletion of nutrients and organic matter, decline of structure and increase of salinity. Land degradation may be of natural or of human origin. Degradation could be compensated by natural restoration that restitutes soil production potential. However, man-made degradation could largely exceed the natural restorative capacity and irreversible processes (http://www.ciesin.org/TG/LU/degrad.html) lead to net soil loss.

The above-cited general concepts of land degradation do not show any specific methodology to conclude degradation level from specific set of soil parameters and process attributes. This reflects the lack of consensus on the nature of the phenomenon and the lack of a general agreement on its "analytical limits". The severity of degradation is typically judged qualitatively (Daily, 1995). Despite the speculations about regional and local problems related to land degradation, in many countries the precise location, extent and characteristics of land degradation are often unknown (Del Vall, 1997). Future soil degradation is likely to have its greatest impact on agricultural incomes due to yield decrease (and input costs growth), in particular in the irrigated lands, in the high-quality rainfed lands, and the densely populated, lower-

From 1970 to 1990 are estimated as 8%. A global agricultural model suggests a slight increase in degradation (relative to baseline trends) could result in 17–30% higher world prices for key food commodities in the year 2020. However, because of the dominance of less-degraded temperate regions (in world food trade on the whole), land degradation appears likely to pose only a modest threat to aggregate global food supply or trade by 2020.

Daily (1995) mentioned that due to the human impact on land use since the middle of the 20th century, more than 40% of vegetated soils worldwide are believed to show lowering capacities for benefit supply. This represents about 10% reduction in the PDIV. Keeping the present trend the same, during the first two decades of the 21st century, the global loss of PDIV could reach 20% whereas the recovery would be about 5%. The slow recovery and restoration rate of the degraded lands make rehabilitation typically needs several decades to several centuries, and in some cases complete restoration is impossible. Consequently, a rapid finance of control and restoration plans is urgently needed to immediately initiate strong rehabilitation measures.

In a recent study sponsored by the UNEP (Oldeman et. al, 1990), it has been evaluated that the extent of soil degradation induced by human activity since 1945 is about 2 billion ha (i.e. 17% of Earth's Vegetated Land "EVL"). Of this, about 750 million ha (38% of EVL) are classified as lightly degraded (defined as exhibiting a small decline in agricultural productivity and retaining full potential for recovery). However, about 910 million ha (46% of EVL) are moderately degraded (exhibiting a great reduction in agricultural productivity; amenable to restoration only through considerable financial and technical investment). About 300 million ha (15% of EVL) are severely degraded (offering no agricultural utility under local management systems; reclaimable only with major international assistance). Finally, about 9 million ha (0.5% of EVL) are extremely degraded (incapable of supporting agriculture and unreclaimable).

The Center for International Earth Science Information Network (CIESIN) at Columbia University (http://www.ciesin.org/TG/LU/degrad.html) mentions that "The 1972 Stockholm Conference on the Human Environment was a milestone in concern over environmental preservation. In 1974, the United Nations called for global action on desertification with the passage of Resolution 3337 recommending a Conference on Desertification (UNCOD) in 1977. Appendix 1 of UNCOD (1978) includes the Plan of Action to Combat Desertification (PACD), consisting of 26 recommendations covering three main domains of intervention. The United Nations Environment Program (UNEP) and the International Soil Reference and Information Center (ISRIC) sponsored the Global Assessment of Soil Degradation (GLASOD), a baseline study that estimates global soil degradation. The 1992-1993 publications of World Resources include a number of global maps from GLASOD and discuss causes of land degradation (World Resources Institute, 1992). The United Nations Conference on Environment and Development (UNCED, 1992) specifically addressed land degradation and desertification in Chapter 12 of "Agenda 21". That chapter emphasizes the global nature of desertification and

serious deterioration of irrigation water and the phreatic water-table could immediately be reflected on soil quality.

From an environmental point of view (that keeps an eye on environmental sustainability), soil does not only produce the needed crops, but also has a major role in running the biogeochemical cycles that regulate Earth environment (greenhouse gases, the total energy balance and biodiversity). Consequently, any reversible or irreversible deterioration of soil is directly reflected in a general economic decline which can be felt more seriously in the poor nations (Daily, 1995). Anthropogenic impacts on the environment have always contributed to land degradation in the prehistoric and historic times. Historically, land degradation has been implicated in the fall of great civilizations (McC. Adams, 1981, and Olson, 1981).

Land degradation, has multiple impacts on the environmental system including changes to flora, fauna, water quality, catchment hydrology, visual amenity and productivity (http://www.ncc.nsw.gov.au/environ/ecatch.htm). Water deterioration can be defined as a net shift from a set of predefined water quality criteria due to natural and/or human-made effects. While the chemical and physical parameters used for accepting (or rejecting) water use for different purposes (irrigation, industry and drinking) are well known (and only subject to insignificant modifications in different countries and cases), the characterization and categorization of soil degradation, and its net impacts, are less obvious issues. The "Potential Direct Instrumental Value (PDIV)" is defined (Daily, 1995) as the potential to yield direct benefits from soil (such as agricultural, forestry, industrial, and medicinal products). The PDIV does not incorporate indirect values (such as services, option values, or nonuse values). Thus, it is a conservative measure of value that could be used to judge the extent of soil degradation. That is to say, the PDIV is not like the Potential Net Primary Production (PNPP). However, because PDIV depends on complex and variable factors (such as human knowledge and preferences), it is impossible to quantify precisely, even if it was viewed from a biophysical perspective (as opposed to a socioeconomic one).

Global Size of the Problem

The annual worldwide loss of land valuable to agriculture exceeds 5-7x10^6hectares/year (http://www.fao.org/inpho/vlibrary/u8480e/u8480e0d.htm). It is clear that this huge annually lost area (=12.5–17.5x10^6 feddans) is larger than all the present-day arable land of Egypt by a factor of 1.50 to 2.2. Also, it is believed that about 75 percent (= 4x10^9 hectares = 10x10^9 feddans) of the Earth's land is already affected by some form of degradation (http://www.ciesin.org/TG/LU/policy.html). A decline in long-term soil productivity is seriously limiting food production in the developing countries, and under the present trend the problem will be getting worse toward the year 2020 (Scherr, 1999). The same author mentioned that the estimates of land loss due to degradation widely vary (from 5x10^6 hectares/year to 12x10^6 hectares/year). For cropland, the cumulative productivity loss due to soil degradation over the past 50 years is estimated to be about 13%, and for pasturelands it is 4%. Due to water erosion alone, crop yield losses in Africa

Accordingly, this paper introduces a monitoring scheme for following-up land degradation and water quality deterioration in an integral package. The paper presents a framework start point concerning the conceptualization of the land degradation problem with interest in the aspects that should not be ignored in any practical treatment of the issue. Also, a comprehensive scheme for land and degradation inspection and monitoring is under preparation. The present scheme should be viewed as a preparatory set of ideas that is currently turned out into a computer model (to appear elsewhere) using adequate sets of logic statements and computational analysis. However, the appendix of this paper (a computer spreadsheet) is available from the author upon request. The presented spreadsheet is a prototype of the intended model.

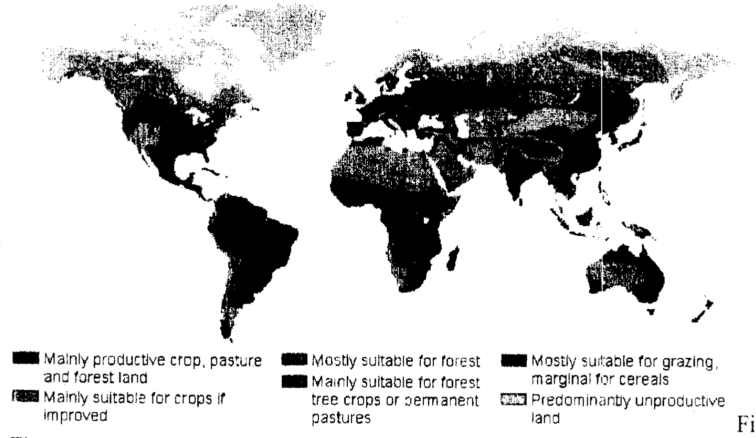


Figure 1. World potential land use capabilities
http://www.fao.org/inpho/vlibrary/u8480e/U8480E0E.HTM

Description and Definition

A good soil is a porous media that can admit, store and recycle moisture, energy and nutrients where these could be available to support worthy plant growth and high production. Soils of the world have a broad diversity in characteristics resulting from the combined effect of their history of formation (starting from widely different parent materials) under distinct climates, biogenic effects and topography. Consequently, lands use capability (Figure 1.) has a wide range of potential worldwide. Land degradation is the sets of natural processes (and the human-induced operations) that controvert and oppose soil functions within the host environmental system. The natural processes and anthropogemic operations contradicting soil function lead to net changes in the ecosystem that show-up as a decline of soil conditions, and results in decrease of agricultural production. Blaikie and Brookfield (1987) present a comprehensive introduction to and definition of the nature of land degradation. The quality of the available water resources is in direct connection to soil characteristics. Soil, in terms of its hydraulic parameters, chemical composition and capacity to produce benefits to humans, is easily get deteriorated through mismanagement, in particular in the irrigated lands. Any

previously formulated elsewhere, probably without direct link to the national and local interests. The shortsighted attitude of some nationals (occupying high administrative positions), the stresses of fund agencies, and the poor definition of environmental problems on the national scale, cut the way before the development of effective national scientific schools specialized in the environmental issues, two-thirds of them related to soil and water.

All these drawbacks enhance the internal dependence on the foreign capital legacy, and this long dependence would be transformed into a sort of a permanent national obsession. In the course of accumulated errors, negative environmental impacts would actively participate in the gradual degradation of natural resources, and little national interest is put in these aspects if no "green lights" were received from abroad. This, in turn, would impose the need for more foreign fund to struggle against environmental degradation. In order to break this infernal cycle dominating the national production activities and the processes of the territorial natural resources protection, national scientists should continue, despite their present difficulties, to contribute to building-up a coherent framework of knowledge for the management of the natural resources. Also, they have to propose ideas that correspond to the best ways for the protection of these resources. In the front of the national tasks comes the charge of land and water degradation control. When the basic issues and concepts of land and water degradation is still faint on the national scale and their boundaries are still obscure or misunderstood, a special effort should first be done in order to relief this national pain.

In arid and semi-arid-regions, soil deterioration is mainly attributed to erosion and/or mismanagement of irrigation projects where salinization has significantly lowered crop yields. Also, urban sewage and industrial pollution has resulted in land damage. Soil degradation and groundwater depletion is at present generalized in many temperate and arid regions worldwide (http://dieoff.org/page65.htm), in particular in the developing countries. Groundwater depletion is extreme in the High Plains Aquifer System, California and the Southwest in the United States, in the Valley of Mexico, the Arabian Peninsula, North Africa, Palestine, Spain, India, North China, and Southeast Asia. Land degradation is exceptional in China, Russia, Iran, Pakistan, India, Haiti, and Australia. Groundwater depletion is due to over-pumping that exceeds natural recharge. In some fossil and coastal aquifer systems, exhausting the groundwater resources is expected to take place within 50 years.

Complicated types of environmental degradation usually accompany the introduction of new irrigated lands (http://www.cedare.org.eg/software/soft4000.shtml). Under the arid and semi-arid zone conditions, water quality and soil conditions of the irrigated lands could by no means separated into two distinct entities, neither on the side of policy making (and project execution) nor on the environmental research side. Consequently, it is not logic to discuss land degradation sans dealing, in the same time, with water quality and water shortage problems.

farmers in order to encourage them control the propagation of the phenomenon, and reducing its impacts. The proposed scheme is aware of the differences between the old and the newly cultivated lands. These differences must be respected in degradation control plans and in research priorities. Also, the presented scheme proposes the involvement of the water deterioration issue into a holistic perspectives of environmental control that positively respond to the unavoidable interaction between soil and water qualities, in particular in the irrigated lands.

INTRODUCTION

One of the major drawbacks of the natural resources management procedures, as applied in the third world countries, is the lack of a coherent theoretical framework for the environmental problems dealt with on the national and/or regional levels. This is consequently turned out very often into acute deficiencies in the economic development policies adopted on both the national and the provincial levels. Usually progress slogans are introduced to the field of the protection of natural resources without an in-depth conceptual analysis of the confronted problems. Also, agricultural expansion policies would be planned and carried out on routine basis without allowing a sufficient pre-reflection stage before starting the fieldwork schemes. In many instances, the initiation of further irrigated agricultural development projects is not foreseen in a prospective of environmental impact. Moreover no long-term strategies are prospected for planning, and no future prediction studies are attempted for estimating the type and size of the visibly coming problems.

Furthermore, environmental questions would be wrongly addressed due to the nonexistence of specialized "think tank" organizations to which rationalization of the national production activities could be assigned. University professors and other research workers are almost discarded from the national decision-making process. Meanwhile, high-rank administrative authorities in the ministries of agricultural, irrigation and environment usually monopolize the definition and supervision of the national projects. However, their day to day routine engagements make them non-preoccupied by generating coherent strategic plans for handling the fundamental and conceptual issues of the management and the applied procedure are rendered unsuccessful on the long term. Consequently, ad hoc development schemes are generally randomly run without an integral consideration of the natural system components and its underlying environmental questions. Even with the initiation of the so-called "national projects", the administrative machine prefers running things "covertly" in order to limit the immediate circles that can interfere with its unlimited power.

Moreover, high-rank executives are greatly impressed, and only interested, by "thought waves" generated in leading foreign organizations and agencies in the developed countries and in the international institutions. These thoughts are, however, mostly not relevant to national conditions. Worse, when international capitals are pumped into the developing countries, the international fund agencies start to impose their own points of view on the funded projects in order to make them accommodate with foreign policies

MONITORING LAND AND WATER DEGRADATION: ENVIRONMENTAL DIMENSIONS AND RESTORATION

Mohamed Fahmy Hussein
Cairo University

ABSTRACT

Under the natural conditions controlling soil and water resources of the arid and semi-arid zones of Africa and the Arab region (pressed down by augmenting man-made stresses, in particular in the irrigated basins and heavy-populated areas), land degradation and water pollution became a crucial issue. Outside the region, this mundane problem is increasingly interesting governments, research organizations and institutions of the civil society. However, some discrepancy is still widely prevailing in important fields such as the conceptual nature of the land degradation, its origin, causes, types, social aspects, monitoring methods and rehabilitation scenarios. This is, in part, due to the wide spectrum of tangent aspects dealt with and to the great diversity of the natural resources touched. Moreover, there is no general consensus or a unique and comprehensive approach on how to tackle the problem.

The present work presents an overview of that global topic on both hypothetical and technical grounds. Through a review of the available literature (from printed documents and through the electronic media on the Internet), the paper outlines an environmental analysis of that problem in what concern the conjunctive deterioration of soil and water resources through a comprehensive scope. As well, the paper introduces a technical scheme for monitoring and following-up land and water quality, and for initiating related strategic policy actions and research priorities.

From an institutional point of view, it is proposed that the General Organization of Land Improvement – GOLI - (Ministry of Agriculture) would elaborate and modernize its actions to tackle the broad aspects of land and waters degradation in conjunction with the Egyptian Agency of Environmental Affairs (EAEA). This modernization would include the implementation of extensive national monitoring programs to follow-up the phenomenon in Egypt. This requires installation of appropriate regional research stations, establishment of environmental awareness centers, and use of modern research and communication equipment. Communication *via* the Internet, data transmission *via* regional computer networks (Intranet), use of automated lysimeters in experiments, application of modeling and isotope approaches in soil and water research and investigation are vital obligations towards the target of modernization in the field of protecting soil and water resources. Harmonization of policy and action plans between the Ministry of Water Resources and the research-oriented establishments (in particular in the Egyptian universities and the Scientific Research Academy) is urgently needed.

As well, preventive measures should be undertaken in each province. Restoration procedures could be undertaken *via* modifying the agricultural extension policies and through accelerated governmental cooperation with

Bobo J. 1956. Un ensemble de stations moustéro-atériennes aux environs de Djanet (Tassili des Ajjers). Note préliminaire. Libyca.4, 263-268.
Bousquet B., 1992. Parc national du Tassili : Conservation, valorisation. Rapport UNESCO-MAB, 206p.
Devillers Ch. 1939. Les dépôts quaternaires de l'Erg Tihodaine (Sahara Centrale). C.R. somm. Soc.Géol.Fr. Paris, 189-190.
De Bois H., A.A. Dhondt & B. Van Puijenbroeck,1990. Effect of inbreeding on juvenil survival of the okapi. *Okapia Johnstoni* in captivity. Biol. Cons., 54, 147-155.
Foureau F. 1905 Documents scientifiques de la mission Saharienne.Pub. Soc. Géog., Masson, Paris, 1210
Gautier E.F. & Reygasse M. 1932. Le monument de Tin Hinan. Ann. Ac. Sci. Col., 7,12.
Ghobrial L.J. 1974. Water relation and requierement of de Dorcas gazelle in the Soudan. Mammalia. 38,1,88-101.
Grettenberger J.F. 1987. Ecology of de Dorcas gazelle in Northern Niger, Mammalia, T51, 4, 527-536.
Joleaud L. 1936. Gisement de vertébrés quaternaire du Sahara. Bull. Soc. Hist. Nat. Afr. Nord. Alger. 26,23-39.
Kilian C. 1992. Essai de synthèse de la géologie du Sahara sud-constantinois et du Sahara centrale, telle qu'elle se présente à ce jour avec les changements apportés aux connaissances antérieures par les observations faites au cours de notre mission de 1922. C.R. XIII Cong. Int. Géol, Bruxelles. 2, 887-945.
Le Berre, M. 1989. Dynamique de l'occupation de l'espace saharien par les vertébrés aquatiques et terrestres. Thèse d'état es Sciences, Univ. Lyon 1,2 vol., 715 p.
Lelubre, M. and J. Cousin 1951. Peintures et gravures rupestres nouvelles de la Tefedest méridionale (Ahaggar, Sahara central). L'Anthropologie. 55(1-2), 48-49.
Lhote, H. & Kelley H. 1936. Gisement acheuléen de l'Erg Admer (Tassili des Ajjers). J.Soc.Africanistes, 6, 217-226.
Mackinnon J.R. & Stuart S.N. , 1988. The kouprey, an action plan for its conservation U.I., Gland, 28p.
Maltz, E.& Shkolnik. A. 1984. Lactational strategies of desert ruminant : The beduin goat, Ibex & Dorcas gazelle. 193-213p. in : Lactation strategies. Symp.Sool..Soc. London.
Vaufrey R. 1969. Préhistoire de l'Afrique. Tome II. Au Nord et à l'Est de la grande forêt. Pub. Univ. Tunis. 4,372.

since 1927. Whereas the cheetah has been found dead once more in djebel Idare (ANN/OPNT)in 1996. The conservation measure of this category has to avoid all sorts of commercialization

*managment for the big ungulate : the Addax particularly very threatened is not exclusively barren but wonder between Admer erg and the Nigerian frontier .The creationof a strict reserve for this species in this area would permit certainly to undertake researches and may be to save the species .So, the given information by the meharist would be of great utilityThe mouflon and small gazelles deserve also particular attention ever of they seem more abundant, their habitats were occupied by pastoralism.

4/ Optimisation of pastoralism

The system of traditional nomad pastoralism is reduced to let place to a pastoralism a lot of more sedentary with overcharge of animals that lead to an unbalance. This problem can be treated in a model oued/caprinae/gazelles . It suits to take into account the two aspects charge/hectare and duration of grazing-ground and to imagine the local solutions in term of rationalization.The solutions exist in two ways :

? restoration of habitats
? rationalization of their use

The actions of research should have objectives :

? the analyses in socio-economic term of oueds, caprinae pastoralism and gazelles breeding
? the experimentaion of tehniques used in biodiversity restauration and vegetal production of oueds.

CONCLUSION

We should suggest a contribution in term of dynamic and integrated micro-system combining conservation and economic productivity The agropastoral context and an ecotourism well oriented deserve a take into account seriously so that to take part in the best way inthe ecodevelopment of Tassili a real natural ecomuseum which its multiple interests for the biosphere are not to be shown.

BIBLIOGRAPHY

A.N.R.H. (Ministère de l'équipement Algérie), 1992. Notice explicative de la carte hydrogéologique du Hoggar et des Tassilis à 1/1 000 000. Projet PNUD/ALG/021.

Arambourg C. & L. Balout. 1952. L'ancien lac de Tihodaine et ses gisements préhistoriques. Actes Cong. Panafr. Préhist., Alger, 281-292p.

Aulagnier S. & Thevenot M. 1986. Catalogue des mammifères sauvages du Maroc. Trav. Inst. Sci., Sér. Zool.,41,1-163p. Rabat. 1986. Les ongulés sauvages du Maroc. Le Courrier de la Nature.104,16-25.

2/ Protection of natural mileu of N'Ajjer Tassili.

Every naturalist feels the necessity of structuring the natural milieu of species in function of particular criteria to his discipline. An essential point here ,is the use of the occupied space by the animals . The availibility of food, water , refuges and quality of the milieu are the criteria suggested by Leberre (1989).This author divided the natural milieu into three categories : sandy milieu, rocky milieu, wet milieu The permanent watery points interfer in a variety of manner in the dynamic of the barren biocenoses in different levels of integration:

? modifications in the physical and chemical qualities of the water are fondamental for the invertebra (insects,, crustaceous)
? the waterpoint allows the development of a particular vegetation that permit to fix primary productive and consumer species attracting secondary consumers.
? the role of the water point as a watering place for the big herbivorous species and farmers, is essential.
? finally, for the development of the seasonal migrations, the role of water points is very important

The water point appears thus as a fundamental element in this natural milieu of Tassili. In case of a dynamic inventory of saharan biocenoses, the priority should be given to these milieui. The protection of this fauna goes through the protection of these different habitats, more precisely, the protection and the restauration of natural habitats of big herbivorous ungulate will have as an immediate consequence mainly the carnivorous. Our suggestions are in agreement with these of Leberre (1989) which point forward conservatory measures for a great number of vertebrae species.The main threats that weigh on vertebre fauna are principally

? the development of tourism
? the runt with developed and modern methods introduced by foreign temporary elements
? the surexploitation of water points ,the situation of their chemical pollution is to be studied too.

3/ Protection of menaced vertebra

a-fish: the status should be largely maintened for the water points where the four species of fish live. In our opinion we should outline the actions of fishing or the great intensive projects of pisciculturesuch as suggested by Bousquet (1992) for the valley of Iherir.

b-reptiles: they seem less menaced, but information must be given to guides to forbide the hunting and the trade or the exportation specially of the three species of this family (Agamidae)

c-mammalians: *carnivorous: their role is fundamental in the regulation of biocenoses animals and plants; someones such as the Lycaon is not observed

Ammotragus lervia : O. Djerat, O. Sersouf, O. Ad,O.Zatou, Takanatine: many samples and marks observed at these places.

Procavidae familly represented by only 1 species
Procavia capensis: O. Ouret, Takanatine, O. Tadjeradjeri, rocky moutains of Central Sahara.

Equidae family represented also by one species.
Equus asinus : O. Djerat, O. Edelb, Outes, Tadjesselt, Takanatine.

Recent observations

During our mission in january 2000 we able to observe some invertebrates among them butterflies and insects and among them some vertebrate : we see fish in the water points of Essendjilene and Assar. The reptile met except some small lezards but we observed a great number of birds (turtle, pigeons). For the small mammals , we have a great number of terriers with marks of rodents observed in the valleys of oueds Arikin and Essendjilene ; hare has been observed too twice in mount Tiniskao towards the highlands of Djider. The hedgehog has also been seen in the valley of Essendjilene.In the gorge of Essendjilene the Rock daman has been seen at the mawimum sunny these mountains seem to be the north limit for this species in Africa.

Measures of preservation and conservancy

Conservancy has emerged as a new science, it includes two types of actions:the programmes of conservancy « in situ » on the surface (rock formation) area and the programmes of conservancy « ex situ » where we protect the bordage captivity of the species. Between these two types of programmes, samples in the nature must serve to establish a protection of security of the population or support of the considered species. The reintroduction should permit the implantation of exterminated species in nature or to serve to reinforce the wild population on the decline before the complete extinction of the species It is stipulated that the main actors of the conservancy programmes are the states organisations and the non states organisations.

1/ Information

The outstanding type of future project consists to let man use his biotope but in measured manner . To be realized, the sensitization of the local populations to the problems of the disappearance of the species contribute to their protection by different actions. In fact , the way of life of the inhabitants of N'Ajjer Tassili evolves towards centres more urbans with the increase of the pression of man on the environment where plants and animals are concerned. A strong compaign of explanationon the topic must be taken inside the Tassili.A specific scholar programme must be planned for future formation of guides .

Ctenodactylidae — *Massoutiera mzabi*: O.Ouret, O.In-Sellet, Adella, Arzajai, Fadnoun, TinEloukou, O.Edelb

Erinaceidae — *Paraechinus aethiopicus*: Aït. Mewene

Rhinolophidae — *Rhinolophus clivosus*

Vespertilionidae — *Pipistrellus deserti*: Arzajai, Tekanatine.
Otonycterus hemprichi

Even more that none of these 16 species is mentionned on the red list of UICN , the fact remains that in our sense they desire a protection. Our attention is bigger towards 15 other species of mammalian of medium and big size recorded in Tassili We can divide them into two groups : the carnivorous and the herbivorous.

Group 1: The Carnivorous
9 species are shared out between 3 families (*red list UICN)

Canidae

Canis aureus: O.Ouret, In Temassissine, Tifnitine, Ajeni, O. Ad, Zatou, Ait Mewene. The most frequent live in valleys and the plateau .
Vulpes pallida: Anou Adjere
* *Vulpes rueppelli* :Tin Eloukou, Zatou, Ait Mewene
**Fennecus zerda*:
**Lycaon pictus*: well known by the Touaregs its presence in the Tassilian massif border is not sure.

Hyénidae

represented by one species
Hyena hyena those density is very low on all the massif.

Felidae

represented by 3 species :
Felis domesticus : present in the border as well as in the centre of Tassili.
Felis margarita: Illizi, and sandy plains
**Acinonyx jubatus* : Admer, Afara and Tamadjert.

Group 2 : The Herbivorous
7 species were reparted in 3 families.

Bovidae

The five species of this group are all threaten and noted on the red list of UICN(*); it is the most studied group on the ecoethological hand, reproduction and metabolism (Aulagnier et Thévenot, 1986; Grettenberger, 1987,Ghobrial,1974; Maltz et Skolnik, 1984).
**Gazella dorcas:* Fadnoun, Tin Eloukou, O. Edelb, Issendjilène, Djider.
**Gazella leptoceros:* Limited to sandy plains and Erg Admer.
**Addax nasomaculatus* Admer (very rare; some marks have been observed after rain episodes in 1985 par Leberre).
**Oryx gazella*: live in large spaces ; it is not a specific desert species but it runs across the Tassili temporarely.

The terrestrian fauna

Reptiles: It consists of unknown group in Tassili because of their furtive character. 21 species are set out in 8 categories :

Crocodylidae	*Crocodylus niloticus* or crocodile of the Nil: has disapeared from the Tassili in 1924 ; Bousqueet (1992) report that the last specimen was killed in 1940 at oued Imirhou.
Viperidae	*Cerastes cerastes* : O.Edelb, O.Tadjeradjeri
	Cerastes vipera : Amguid, Illizi
Colubridae	*Psammophis sibilans* : Arzajaï
	Malpolon moilensis: Arzajaiî
	Lytorhynchus diadema
	Coluber rhodorachis : Djanet
Scincidae	*Chalcides ocellatus*
	Scincus scincus
Varanidae	*Varanus griseus* : Erg Admer
Lacertidae	*Mesalina rubropunctate* : Akba de Taramat
	Acanthodactylus sp. : O.Ouret,O.In Sellet,O.Tadjeradjeri
Agamidae	*Agama impalearis* : O.Ouret,In Houlila,O.Edelb
	Agama mutabilis : O.Illizi
	Uromastix acanthinurus :O.Ouret,Tin Eloukou, O.Edelb,O.Tadjeradjeri
Geckonidae	*Ptyodactylus hasselquisti* : O.Ouret, In Houlila, O.Tadjeradjeri
	Stenodactylus stenodactylus
	Tarentola ephippiata
	Tropicolotes steudneri : Amguid

Mammals : Set out in 14 families, 31 species. The small mammals (8 families and 16 species seem not to be in danger because they are little exacting for food and for unlucky behaviour on the agriculture and as carrier of diseases.

Leporidae :	*Lepus capensis*: Fadnoun (south of Illizi.)
Gerbillidae :	*Gerbillus. pyramidum*: O.Ouret, Arzajai, Tiswar, Ait-Merwene, Dider, .
	Gerbillus. gerbillus
	Gerbillus campestris :Aharhar, Sersouf
	Gerbillus nanus
	Meriones crassus
	Psammomys obesus
Muridae	*Mus musculus*: Illizi
	Acomys cahirinus: O.Ouret, Arzajai, Askou, Ihérir, Aharhar, Sersouf Edelb,
	Lemniscomys barbarus
Dipodidae	*Jaculus jaculus*

several species of gazelles (between them *Gazella dorcas*), theOryx (*Oryx gazella*), theAddax (*Addax nasomaculatus*), the wild sheep (*Ammotragus lervia*), the Bouquetin (*Capra ibex*), the giraffe (*Giraffa camelopardalis*), theOkapi(*Okapia johnsoni*), the dromedary (*Camelus dromedarius*), the wild equus (*Equus asinus*), the horse (*E. caballus*), the elephant (*Loxodonta africana*), thehippopotamus (*Hippopotamus amphibius*), the white rhinoceros (*Ceratorhimus simus*) and some suidae. Among these herbivores are associated some carnivores, small mammals and primates. This listing selected species which have interest for man ; they permit to review the natural environment of Tassili in the holocene period linked to a rich vegetation progressively supplied by desertic environment.

The existing fauna :The actual inventory of vertebrates of the Tassili has been realised by Leberre (1989) and completed by our observations in january 2000 in some regions of Tassili : Amaïs, Arikin, Ighram, Takisset (SE Djanet) and Assassou, Eil, Essendilène,Tanaret,Sersouf, Ouariren, Zawatallaz, Djider, Akanama, Idaren, Ihérir, Hassi Tabenkert, Tazrekou, Tintaharedjli (NE Djanet). We report here the species , their location and their degree of vulnerability such as studied by UICN

The aquatic and subaquatic fauna :

Fish: Generally identified in the watery points especially in Ihérir and Imirhou sites related to a humid past

Cyprinidae	*Barbus deserti*: o.Djerat, o.Ihérir, o.Ouret, o.Tadjeradjeri *Barbus biscarensis*:o.Djerat, o.Ihérir, o.Sersouf, o.Aharhar, o.Ouret,o.Tadjeradjeli
Clariidae	*Clarias gariepinus*:o.Tadjeradjeri, o.Ihérir,o.Tarat
Cyprinodontidae	*Gambusia affinis* (introduced species)
Cihlidae	*Tilapia zilii*: o.Ihérir, o.Aharhar, o.Ouret, o.Tadjeradjeri

Amphibia: We know five species but only two ones are signaled ; they are infeoded to aquatic milieu and at least may translate their existence by biological quality.

Ranidae	*Rana ridibunda*: o.Ouret, o.Sersouf, Guelta Houlila, o.Ihérir, o.Aharhar, o.Tadjeradjeri *Phychadena mascaraniensis*: signaled in 1908 at O. Ifédil
Bufonidae	*Bufo regularis*:o.Tadjeradjeri,o.Ihérir *Bufo mauritanicus*: signaled but not seen since many years *Bufo viridis* signaled by Dumont (1986) Aharhar valley.

The understanding and the knowledge of the geological structure often let ones to understand better the conditions of the receptions of the « biocenoses ».

Geographically, the Tassili is constituated by a set of ancient sedimenters rock formation,remained by volcanic activity in tertiary era. Well studied by Killian (1922) we distinguish four regions :

? pretassilian lands
? enclosed space constitued of 3 sets :external tassili, intratassilian trail and internal tassili
? the Adrar N'Ajjer is a volcanic formation, and
? the volcanic complex (tertiary, early quaternary).

The volcanism is trully visible on the southern (meridional) part. The geological structure of the Tassili and the geographical model that arises have for facts to determine the privilegied and the sacrified areas on the survey on water resources.

In Tassili the hydrographical system is very imprtant ; in consequence of the geomorphology, two slopes decline asymetrically are defined. The study of ANRH (1992) shows that in the Tassili North and South reservoirs offer important water resources.

Because of lack of meteolorogical stations inside the mass dismissals, the climate belong to the barren continental moutains ; the Tassili is part of hot deserts, characterized by long periods within useful rains that can interfer in the metabolism living creatures.

Some biological signs suggest that the Tassili N'Ajjer has preserved since the rainy period holocene, points of permanent water and its biological activity has never been interrupted ; this is confirmed by the living fish in the aquatic resorts.

Inventory of the fauna patrimony

The paleofauna :The fossiliferous sites known and exploited are all situated at the border of the Tassili ; five sites are known and exploited until today : the layers of the Erg Tihodaïne (Gautier et Reygasse, 1932 ; Joleaud, 1936 ; Devillers 1939-1950 ; Arambourg et Balout, 1952, ; Vaufrey, 1969), the Admer Erg (Lhote et Kelley, 1936), Djanet (Bobo, 1956), Issaouane Erg (Fourreau, 1905) and of Tissemt (Lelubre et Cousin, 1951) on the western borders of the Tassili.These did not represent total layers of the fossiliferous quaternaire of the region.In addition numerous pictures and rupestre paintings constitute a rich iconography which permit to appreciate the evolution of the Tassilian biocenoses ; they translate the variety of vertebra fauna where fish, amphibian and reptiles groups are rarely represented ; the most frequent species are birds and mammals. Among mammals we name :the antique Bubale (*Bubalus antique*), the Buffle (*Syncerus caffer*), the domestic bovidae (*Bos sp*), the Bubales (*Alcelaphus buselaphus*), the Hippotragues (*Hippotragus equnus*),

ANIMAL RESOURCES IN ALGERIAN CENTRAL SAHARA (TASSILI NATIONAL PARK)

Farida Khammar

Arid Zones Research Laboratory.
Houari Boumediene Science and Technology University
B.P 44 Alger-Gare 16000. DZ ALGIERS-ALGERIA

ABSTRACT

The Tassili is a recent volcanic massif and reaches 2200 meters north of Admer erg. It was inserted in the international network « Des réserves de l'Homme et de la Biosphère » (MAB-UNESCO) in 1986. It is the first reserve of the Saharan biosphere in the world.

The Tassili ecologic equilibrium is very fragile ; water is extremely precious :gueltas or adjelman are the natural resources permanent or temporary considered like vital cases for animals and man.
The vegetation is rare and does not occur in the large areas. However, it does grow intensively in the river bords and canyons.

Animals adapted themselves to hard conditions what make them a particular interest :antelopes have recently disappeared and the cheetah is on the way ; nevertheless, some big mammalians are present : the mouflon still bears the life in the steeper areas and gazelles are numerous notably in the ergs.

We should notice the existence of 31 species of mammals among them the saharan goundi « Akaoka » (Procavia capensis) and 21 species of reptiles ; if the last crocodile was killed in 1940 fish and an interesting microfauna still live in some gueltas.

The current arid phase represents the end of a continuous dryness ocurring since 10,000 years. Very few minutes are sufficient to blast millenaries of history. In 1982, the Tassili was integrated to the international patrimony list of UNESCO owing to its archeologic richness and especially wellknown paintings and prehistoric drawings and engravings ; so in Algeria legislation related to this patrimony protection is very severe.

Presentation of the investigated area and the natural environment

Situated in almost the geographical centre of the Sahara (between 5° and 10° longitude east and 23° and 17° latitude north), the Tassili N'Ajjer area is located in the eastern extension of the Mouydir ; it is limited to the east by Lybia and to the south by Niger ; the altitudes stretch between 550m and 2254m. Administratively, it is situated in the wilaya of Illizi.

الترابط بين تيار الماء لنهر النيل والظواهر المناخية العالمية

د. حسني محمد سيد هاشم

تم التحليل الإحصائي لبيانات أهم ثلاث محطات هيدرلوكية (أسوان-الخرطوم-ملكال) فوق نهر النيل وذلك لإيجاد العلاقة بين تيار الماء لنهر النيل وكل من ظاهرة النينو (El Nino) والتذبذب الجنوبي (Southern Oscillation) ودرجة حرارة سطح الماء فوق الأطلنطي. وقد تم اكتشاف تأثير هذه الظواهر على تيار نهر النيل. ولوحظ أن معدل كمية المطر لحوض نهر النيل تعتمد في الأساس على كل من مكان الحزام التجمع بين الاستوائي (Inter Tropical Convergence Zone, ITCZ) والتغيير المداري الطولي لدرجة حرارة سطح البحر. وهذه التغيرات لدرجة حرارة سطح البحر لها تأثير ظاهر على مكان وشدة الحزام التجمع بين الاستوائي والذي بدوره يؤثر على المطر على الساحل الأفريقي ومن ثم على تيار الماء فوق نهر النيل.

وقد وجدت علاقات موسمية وسنوية عكسية بين تيار الماء لنهر النيل وظاهرة النينو بينما هذه العلاقات طر دية بين التيار الماء وظاهرة "التذبذب الجنوبي". كما تبين أن ظاهرة "التذبذب الشمال أطلنطي (North Atlantic Oscillation)" وحرارة سطح البحر للشمال الأطلنطي الاستوائي لهما تأثير ضعيف جدا. بينما تأثير حرارة سطح البحر للجنوب الأطلنطي الاستوائي يكون مشابه لتأثير ظاهرة النينو على تيار الماء لنهر النيل. وعلى عكس الفصول نجد أن تيار الماء في فصل الربيع له علاقة طر دية مع ظاهرة النينو وحرارة سطح البحر للمحيط الأطلنطي.

WCRP, August, 1997: A research programme on climate variability and predictability for the 21st century, NO.101, WMO/TD NO.853, ICPO NO.10.

Zwart, B., 1992: Het klimaat verandert. Meteorologgica, 1, 8-10.

Zwart, B., 1993: Het klimaat verandert. Zenit, February, 90-94.

Krueger, A. F., and Winston, J. S., 1975: Large scale circulation anomalies over the tropics during 1971-1972. Mon. Wea. Rev., 103, 465-473.

Lasheen, A. M., 1990: Outstanding causes of moisture distribution over Northern Hemispherical Africa in Summer. Ph.D. Thesis, Cairo University, Egypt.

Leroux, M., 1988: La variailite des precipitations en Afrique Occidentals: Less composantes aerologiques du probleme. Veille Climatique Satellitairs, No. 22, pp. 26-45.

Lough, J. M., 1986: Tropical Atlantic sea surface temperature and rainfall variations in Subsaharan Africa. Mon. Wea. Rev., 114, 561-570.

Maheras, P. 1985: A factorial analysis of Mediterranean precipitation. Arch. Met. Geoph. Biocl. Ser, B36, 1-14.

Mood, A. M., Graybill, F. A., Boes, D. C., 1974: Introduction to the theory of statistics. London: McGraw-Hill, 564pp.

Newell, R.E., Kidson, J.W., 1984: African mean wind changes in Sahelian wet and dry periods. J.Clim. 4, 1-7.

Nicholson, S.E.,1988: Land surface-atmosphere interaction: Physical processes and surface changes and their impact. Progress in physical Geography, 12, 36-65.

Nicholson, S.E.,1989: Long-term changes in African rainfall. Weather, Vol. 44, No. 2. 46-56.

Ogallo, L., 1985: Impacts of the 1982-1983 ENSO Event on Eastern and Southern Africa. Workshop on the societal impacts associated with the 1982-1983 Worldwide Climate Anomalies, Lugano, Switzerland.

Pandzic, K., 1988: Principal component analysis of precipitation in the Adriatic-Pannonian area of Yugoslavia. J. of Climate, 8, 357-370.

Pandzic, K., and Trninic, D., 1998: The relationship between the Sava River Basin Annual precipitation, its discharge and the large-scale atmospheric circulation., Theo. and Appl. Climatology, 61, 69-76.

Philander, S.G. H., 1990: El Nino, La Nina, and the Southern Oscillation. Academic Press, 293pp.

Trenberth K.E., 1976: Spatial and temporal variations of the Southern Oscillation. Quart. J. Roy. Met. Soc., 102, 639-653.

Trenberth K.E. , 1984: Signal versus noise in the Southern Oscillation. Mon. Wea. Rev., 112, 326-332.

Trenberth K.E. , and D. E. Shea, 1987: On the evolution of the Southern Oscillation. Mon. Wea. Rev., 115, 3078-3096.

Trenberth K.E. and Hurrell, J.W., 1994: Decadal atmosphere-ocean variations in the Pacific. Clim. Dyn., 9, 303-319.

Tourre, I, and Lamb, P. J., 1997: A research programme on climate variability and predictability for the 21st century, NO.101, WMO/TD NO.853, ICPO NO.10.

Wang, G. and Eltahir, Elfatih A. B., (1998): Use of ENSO information in medium and long range forecasting of the Nile floods. J. Climate, Vol. 12, No. 6, 1726-1737.

Ward, M. N., 1998: Diagnosis and short-lead time prediction of summer rainfall in tropical North Africa at interannual and multidecadal timescales. J. Climate, Vol. 12, No. 6, 3167-3191.

disastrous environmental and socio-economic impacts WCRP (1997). Weakened trade winds, the southward displacement of the ITCZ and enhanced equatorial convection are features common to both the Atlantic and the Pacific regions during an El Nino (warm SST anomaly).

Acknowledgement

The author would like to express his gratitude to the referees for their constructive comments and suggestions. I am very grateful to the Ministry of Water Resources of Egypt and National Center for Atmospheric Research (NCAR) for providing us by the data, which it used here. Very grateful to my colleagues in the Astronomy and Meteorology Department, Cairo University for they're helpful advise.

REFERENCES

Berlag, H.P., 1966: The southern oscillation and world weather. Mededl. Verhandel., 88, Kon. Ned. Meteor. Inst., 152.

Bliss, E.W., 1925: The Nile flood and world weather. Mem. Ry. Meteorol. Soc., Vol. 4., No. 36. 53-84.

Boko, M., 1989: The schemes of recent climatic fluctuations on tropical west Africa. International seminar on climatic fluctuations and water Management, 11-14 December 1989, Cairo, Egypt.

Camberlin, P., 1996: Rainfall anomalies in the source region of the Nile and their connection with the Indian summer Monsoon. J. of Climate, Vol. 10, No. 6, 1380-1392.

Carrol, E.B., 1995: Practical subjective application of the omega equation and Sutcliffe development theory. Meteorol. Appl., 2, 71-81.

Daley, R., 1991: Atmospheric data analysis. Cambridge: Cambridge University Press, 457pp.

Ehrendorfer, M., 1987: A regionalisation of Austria's precipitation climate using principal component analysis. J. of Climate, 7, 71-81.

Eltahir, A.B.E., 1996:El Nino and natural variability in the flow of the Nile River. Water Resources Research. Vol. 32, No.1, 131-137.

Folland, C., Owen, J., Ward, N. M., and Colman, A., 1991: Prediction of seasonal rainfall in the sahel region using empirical and dynamical methods. J. of Forecasting, Vol. 10, 21-56.

Hall, N.M.J. Hoskins, B.J., Valdes, P.J., and Senior, C.A., 1994: Storm tracks in high resolution GCM with doubled carbon dioxide. Q.J.R. Meteorol. Soc. 120, 1209-1230.

Hastenrath, S., 1990: Diagnosis of African drought. WMO/TD No. 363.

Joseph, B., and Goswami, P., (1999): Effect of land-ocean contrast on the structure of anomaly tropical circulation. Dynamics of Atmospheres and Oceans, vol. 28, 205-228.7

Kanamitsu, M., and Krisnamurti, T. N., 1978: Northern summer tropical circulations during drought and normal rainfall months. Mon. Wea. Rev., 106, 331-347.

Klein S. A., Soden, B.J., and Lau, N –C., 1998: Remote sea surface temperature variation during ENSO evidence for tropical atmospheric bridge. J. of Climate, Vol. 12, No. 4, 917-932.

Table 8b Correlation coefficient matrix between Stream flow and sea surface temperature of Tropical Atlantic Ocean at Khartoum hydraulic station.

	WINTER	SPRING	SUMMER	AUTUMN	ANNUAL
Winter	-0.37**	-0.23	-0.32*	-0.36**	-0.31*
Spring	0.13	0.13	0.17	0.19	0.17
Summer	-0.32*	-0.20	-0.39**	-0.42**	-0.33*
Autumn	-0.37**	-0.13	-0.38**	-0.40**	-0.30*
Annual	-0.43**	-0.22	-0.49**	-0.51**	-0.40**

Table 8c Correlation coefficient matrix between Stream flow and sea surface temperature of Tropical Atlantic Ocean at Malakal hydraulic station.

	WINTER	SPRING	SUMMER	AUTUMN	ANNUAL
Winter	-0.36**	-0.07	-0.19	-0.33*	-0.19
Spring	0.05	-0.09	0.03	0.06	-0.03
Summer	0.12	0.18	0.23	0.21	0.21
Autumn	-0.13	-0.03	-0.08	-0.12	-0.06
Annual	-0.06	-0.07	-0.03	-0.05	-0.06

**** significant at 99% confidence level**

*** significant at 95% confidence level**

CONCLUSION

Meteorological system such as SSTs over Pacific and Atlantic Oceans, and Southern Oscillation seems to play an important role together with Inter-tropical convergence zone (ITCZ) and consequent rainfall or stream flow over River Nile. Considering the Hadley cell evolution (north and south) on Africa, it is noticed that the duration of amount of precipitation depends on location of the ITCZ.

The variation of the inter-hemispheric sea surface temperature (SST) gradient has a significant impact on the position and intensity of the ITCZ, which in turn influence the rainfall over the Sahel in Africa and consequent the stream flow over River Nile. When a warm surface temperature anomaly occurs to the north of the equator, the ITCZ is shifted north of its normal position and atmospheric convection activity accordingly follows the ITCZ northward, causing unusually high rainfall in Sahel region. The opposite happens when the SST condition is reversed.

The results achieved of correlation coefficient above reveal that during El Nino event the stream flow is decrease and vice verse with spring season. Sea surface temperature of Atlantic Ocean is like El Nino relationship with stream flow over River Nile. While Southern Oscillation is opposite relationship of El Nino event with stream flow. The impact of North Atlantic Oscillation on stream flow over River Nile is very weak.

Although sea surface temperature anomalies in the tropical Atlantic are weaker than those associated with El Nino, they can lead to shifts in climatic patterns over Africa and the Americas that can have major and sometimes

Table 7c Correlation coefficient matrix between Stream flow and sea surface temperature of Southern Atlantic Ocean at Malakal hydraulic station.

	WINTER	SPRING	SUMMER	AUTUMN	ANNUAL
Winter	-0.18	0.05	-0.04	-0.28*	-0.07
Spring	0.06	0.13	0.02	-0.02	0.07
Summer	0.12	0.37**	0.22	0.14	0.29*
Autumn	-0.05	0.06	0.05	-0.11	0.02
Annual	-0.01	0.12	0.04	-0.08	0.05

**** significant at 99% confidence level**

*** significant at 95% confidence level**

c) Tropical Atlantic Ocean (TA)

Table (7a,b, and c) shows that correlation between stream flow (SF) and tropical Atlantic Ocean at three hydraulic stations (Aswan, Khartoum, and Malakal) over River Nile. From table 7 one can find that, winter SF is negative correlated with all seasons and annual TA with an exception of spring SF at Aswan. While it is indicated positive correlated with winter and autumn TA at Malakal. Spring season of SF and all seasons and annual of TA are positive correlated with highly significant 99% confidence level at Aswan. In summer season Aswan and Khartoum SF is strong negative correlated with winter, summer, and autumn TA. In autumn season and annual, Aswan and Khartoum SF are correlated with 99% significant confidence level with all seasons and annual TA with an exception of spring season.

Many researchers found strong relationship between Sahelian rainfall, and consequent stream flow over River Nile, and Atlantic Ocean sea surface temperature such as Lough, (1986), Ropelewski and Halpert (1987) and Hastenrath, (1990). Tropical Atlantic SSTs are connected to out-of-phase rainfall anomalies in the Sahel region, Ward (1998). Sahelian rainfall variability is closely linked to the latitudinal position of the inter-tropical convergence zone (ITCZ) and the meridional sea surface temperature SST gradient in the tropical Atlantic, Tourre and Lamb (1997).

The Atlantic Ocean SST fluctuations correspond to those of the northern and southern hemisphere oceans as a whole. The northern Indian Ocean tends to warm up roughly in phase with the Southern Hemisphere as a whole. There is a general correspondence with the rainfall fluctuations in the Sahel with wet (dry) periods in Sahel apparently associated with negative (positive) anomalies in differential (SH-NH) ocean SST.

Table 8a Correlation coefficient matrix between Stream flow and sea surface temperature of Tropical Atlantic Ocean at Aswan hydraulic station.

	WINTER	SPRING	SUMMER	AUTUMN	ANNUAL
Winter	-0.38**	-0.23	-0.33*	-0.39**	-0.32*
Spring	0.38**	0.32*	0.46**	0.44**	0.41**
Summer	-0.34**	-0.15	-0.32*	-0.35**	-0.27
Autumn	-0.56**	-0.32*	-0.57**	-0.63**	-0.52**
Annual	-0.45**	-0.27	-0.45**	-0.51**	-0.42**

Table 6c Correlation coefficient matrix between Stream flow and sea surface temperature of Northern Atlantic Ocean at Malakal hydraulic station.

	WINTER	SPRING	SUMMER	AUTUMN	ANNUAL
Winter	0.06	0.20	-0.04	-0.14	0.10
Spring	0.04	-0.03	-0.22	-0.07	-0.09
Summer	0.00	-0.02	-0.14	-0.03	-0.05
Autumn	0.01	0.16	-0.02	-0.11	0.08
Annual	0.02	0.06	-0.14	-0.10	-0.01

**** significant at 99% confidence level**

*** significant at 95% confidence level**

b) South Atlantic Ocean (SA)

Correlation coefficients between stream flow (SF) at three hydraulic stations over River Nile and South Atlantic Oscillation (SA) sea surface are present in table (6a, b, and c). Correlation coefficient between winter SF and autumn SA are negative at Aswan and Malakal station, and between winter SF and winter SA at Khartoum station. Spring SF at Aswan and spring SA are positive correlated. The correlations between summer SF at Aswan station and winter SA are strong negative correlation. The same negative correlation was found between summer SF and winter, summer, autumn, and annual SA at Khartoum. While positive correlation between summer SF and spring and annual SA at Malakal station is found. There are strong negative correlation with 99% significant confidence level between autumn SF and all seasons and annual SA at Aswan station. While at Khartoum and Malakal stations there is no significant correlation between autumn SF and SA. Strong negative correlation between annual SF and winter, and autumn SA for Aswan and winter, summer, and annual SA for Khartoum station are found.

Table 7a Correlation coefficient matrix between Stream flow and sea surface temperature of Southern Atlantic Ocean at Aswan hydraulic station.

	WINTER	SPRING	SUMMER	AUTUMN	ANNUAL
Winter	-0.22	0.01	-0.15	-0.32*	-0.15
Spring	0.18	0.46**	0.27	0.21	0.37**
Summer	-0.41**	0.10	0.01	-0.17	-0.04
Autumn	-0.46**	-0.28*	-0.41**	-0.42**	-0.41**
Annual	-0.44**	-0.06	-0.24	-0.36**	-0.25

Table 7b Correlation coefficient matrix between Stream flow and sea surface temperature of Southern Atlantic Ocean at Khartoum hydraulic station.

	WINTER	SPRING	SUMMER	AUTUMN	ANNUAL
Winter	-0.42**	-0.12	-0.12	-0.26	-0.19
Spring	-0.05	0.27	0.31*	0.32*	0.30*
Summer	-0.45**	-0.23	-0.31*	-0.36**	-0.34**
Autumn	-0.26	-0.16	-0.20	-0.13	-0.20
Annual	-0.42**	-0.23	-0.29*	-0.26	-0.31

Table 5c Correlation coefficient matrix between Stream flow and North Atlantic Oscillation at Malakal hydraulic station.

	WINTER	SPRING	SUMMER	AUTUMN	ANNUAL
Winter	-0.07	0.03	-0.19	0.19	0.03
Spring	-0.12	-0.20	0.03	0.04	-0.28*
Summer	-0.09	0.18	0.12	-0.42**	-0.27
Autumn	-0.04	-0.03	-0.01	0.08	-0.18
Annual	-0.13	-0.07	-0.13	-0.07	-0.29*

**** significant at 99% confidence level**

*** significant at 95% confidence level**

Correlation between Atlantic sea surface temperature and stream flow

Although sea surface temperature anomalies in the tropical Atlantic are weaker than those associated with El Nino, the Atlantic equatorial mode can have an effect on climatic patterns over Africa.

a) North Atlantic Ocean (NA)

Correlation coefficients between stream flow (SF) at three hydraulic stations (Aswan, Khartoum, and Malakal) over River Nile and North Atlantic sea surface temperature are presented in table (5a,b, and c). From table 5 one can see that there is no significant correlation between SF and NA at all three hydraulic stations with an exception of summer SF and spring NA at Khartoum station and autumn SF with autumn NAO at Aswan station, which indicate negative correlation.

Table 6a Correlation coefficient matrix between Stream flow and sea surface of North Atlantic Ocean at Aswan hydraulic station.

	WINTER	SPRING	SUMMER	AUTUMN	ANNUAL
Winter	-0.04	0.06	-0.15	-0.24	-0.02
Spring	0.09	-0.07	0.00	0.10	-0.02
Summer	0.01	-0.05	-0.10	-0.14	-0.04
Autumn	-0.16	-0.05	-0.11	-0.29*	-0.09
Annual	-0.08	-0.07	-0.15	-0.24	-0.09

Table 6b Correlation coefficient matrix between Stream flow and sea surface temperature of Northern Atlantic Ocean at Khartoum hydraulic station.

	WINTER	SPRING	SUMMER	AUTUMN	ANNUAL
Winter	0.15	0.16	0.00	-0.10	0.12
Spring	0.14	-0.01	0.00	0.10	0.01
Summer	0.15	-0.40	0.04	-0.09	0.12
Autumn	-0.23	-0.06	0.01	-0.18	-0.05
Annual	-0.10	0.01	0.00	-0.18	0.00

Correlation between North Atlantic Oscillation (NAO) and Stream flow

The North Atlantic Oscillation (NAO) is the alternation of atmospheric mass between the subtropical and sub-polar regions of North Atlantic Ocean. NAO is characterized by variations on monthly and seasonal time-scale in the regional sea level pressure gradient, the mid-latitude westerlies, sea surface temperatures and the climate of adjacent land area.

Correlation coefficients between stream flow (SF) at three hydraulic stations (Aswan, Khartoum, and Malakal) over River Nile and North Atlantic Oscillation are presented in table (5a,b, and c). From table 5 one can see that the significant correlation between SF and NAO was weak at all three hydraulic stations. Spring, autumn, and annual SF is negative correlated with winter NAO at Aswan station, also, summer SF is correlated with autumn and annual NAO. At Khartoum station, stream flow of spring is negative correlated autumn NAO, and summer SF is negative correlated with annual NAO. Spring SF is highly significant (99%) negative correlation with autumn NAO at Malakal station. Also, spring and annual SF is negative correlated with annual NAO.

Link between stream flow over River Nile and North Atlantic Oscillation (NAO) was found weak. NAO has more effect on Western African than Sahelian region, Tourre and Lamb (1997). A major transition of NAO between decadal periods of extreme states (low to high) in the early 1970's coincided with shifts in rainfall patterns in Western Africa, WCRP, (1997).

Table 5a Correlation coefficient matrix between Stream flow and North Atlantic Oscillation at Aswan hydraulic station.

	WINTER	SPRING	SUMMER	AUTUMN	ANNUAL
Winter	-0.16	0.04	0.11	0.14	0.04
Spring	-0.37**	0.14	0.04	0.06	0.10
Summer	-0.02	0.12	0.02	-0.09	-0.07
Autumn	-0.32*	-0.10	-0.29*	-0.02	-0.24
Annual	-0.38**	[illegible]	-0.28*	[illegible]	[illegible]

Table 5b Correlation coefficient matrix between Stream flow and North Atlantic Oscillation at Khartoum hydraulic station.

	WINTER	SPRING	SUMMER	AUTUMN	ANNUAL
Winter	-0.18	-0.14	0.09	-0.22	-0.19
Spring	0.13	-0.14	0.09	-0.31*	-0.14
Summer	-0.16	0.01	-0.08	0.02	-0.28*
Autumn	0.12	-0.03	0.18	0.11	0.12
Annual	-0.18	-0.05	-0.06	0.11	-0.05

(1987). Table 4a, b, c present the correlation between stream flow (SF) over three hydraulic stations and Southern Oscillation (SO). Positive correlation between winter SF and winter SO are found only at Khartoum hydraulic station. While negative correlation between spring SF and summer, and autumn SO are found only at hydraulic Aswan station. Autumn and annual SF in Aswan and Khartoum hydraulic stations are positive correlated with all seasons and annual SO with an exception of spring SO. This results agree with other researchers, e.g., Bliss (1925), Berlag (1966), Carnier (1979), Berlag (1966), Laban Ogallo (1985), Nicholson (1989), Quinn (1992), Moss et al. (1994), and Camberlin (1996). Bliss (1925) lists the Nile flood as one of 10 geophysical variables that are related to a Southern Oscillation index. Berlag (1966) found evidence of significant correlation between indices of the Southern Oscillation and several individual stations around the globe. The study of Quinn (1992) explores the use of the historical of maximum Nile flood to extend the records of the Southern Oscillation index. In recent studies, Moss et al. (1994) use the Southern Oscillation index as a predictor of the probability of low stream flows in New Zealand. Camberlin (1996) found that statistical connection between East Africa rainfall and the Southern Oscillation Index.

Table 4a Correlation coefficient matrix between Stream flow and Southern Oscillation at Aswan hydraulic station.

	WINTER	SPRING	SUMMER	AUTUMN	ANNUAL
Winter	0.23	0.24	0.19	0.23	0.26
Spring	-0.27	-0.11	-0.28	-0.31*	-0.25
Summer	0.27	0.19	0.24	0.25	0.29*
Autumn	0.39**	0.32*	0.37**	0.41**	0.41**
Annual	0.32*	0.31*	0.30*	0.32*	0.37**

Table 4b Correlation coefficient matrix between Stream flow and Southern Oscillation at Khartoum hydraulic station.

	WINTER	SPRING	SUMMER	AUTUMN	ANNUAL
Winter	0.31*	0.20	0.26	0.23	0.27
Spring	0.06	-0.07	-0.05	-0.05	-0.04
Summer	0.10	0.08	0.20	0.12	0.18
Autumn	0.35**	0.18	0.28*	0.35**	0.31*
Annual	0.33*	0.20	0.32*	0.34**	0.34**

Table 4c Correlation coefficient matrix between Stream flow and Southern Oscillation at Malakal hydraulic station.

	WINTER	SPRING	SUMMER	AUTUMN	ANNUAL
Winter	0.23	0.23	0.26	0.26	0.24
Spring	0.01	0.11	-0.07	-0.07	0.01
Summer	-0.08	-0.06	-0.16	-0.17	-0.14
Autumn	0.10	0.13	0.19	0.08	0.13
Annual	0.06	0.15	0.06	0.00	0.08

**** significant at 99% confidence level**

*** significant at 95% confidence level**

annual flow of the Nile is significantly regulated by El Nino and Southern Oscillation. Wang and Eltahir (1998).

The physical meaning of why ENSO signals appear in Nile River flow may be due to, during the ENSO the dominant tropical center of convective activity and rising motion shifted eastward (over the Pacific) resulting-in an altered configuration of east-west overturning circulation cells (Walker cells) and enhanced subsidence over Africa. A major component of the Pacific El Nino is the east-west shift of convection from the maritime content towards the dateline and the "Seesaw"" of the surface pressure. In contrast, the observed changes in cloudiness over the Atlantic are oriented primarily meridionally. This situation is the cause of African drought, particularly inter-annual rainfall variability.

Table 3a Correlation coefficient matrix between Stream flow and Nino3.4 at Aswan hydraulic station.

	WINTER	SPRING	SUMMER	AUTUMN	ANNUAL
Winter	-0.26	-0.22	-0.25	-0.28*	-0.25
Spring	0.28*	0.15	0.35**	0.32*	0.28*
Summer	-0.25	-0.24	-0.33*	-0.31*	-0.30*
Autumn	-0.38**	-0.24	-0.45**	-0.49**	-0.41**
Annual	-0.30*	-0.26	-0.36**	-0.38**	-0.35**

Table 3b Correlation coefficient matrix between Stream flow and Nino3.4 at Khartoum hydraulic station.

	WINTER	SPRING	SUMMER	AUTUMN	ANNUAL
Winter	-0.29*	-0.20	-0.29*	-0.30*	-0.27
Spring	0.02	0.04	0.02	0.09	0.05
Summer	-0.13	-0.11	-0.22	-0.25	-0.18
Autumn	-0.33*	-0.16	-0.43**	-0.43**	-0.36**
Annual	-0.31*	-0.20	-0.45**	-0.44**	-0.38**

Table 3c Correlation coefficient matrix between Stream flow and Nino3.4 at Malakal hydraulic station.

	WINTER	SPRING	SUMMER	AUTUMN	ANNUAL
Winter	-0.29*	-0.11	-0.26	-0.31*	-0.22
Spring	0.09	-0.04	0.14	0.16	0.08
Summer	0.12	0.10	0.19	0.19	0.17
Autumn	-0.09	-0.10	-0.15	-0.09	-0.09
Annual	-0.01	-0.08	-0.01	0.02	-0.02

**** significant at 99% confidence level**

*** significant at 95% confidence level**

Correlation between southern oscillation (SO) and stream flow

The SO has a time scale of 2-7 years. Trenberth (1976) and consists of a global-scale, predominantly standing wave with centers of action in surface pressure over Indonesia and the tropical South Pacific, Trenberth and Shea,

Table 2a Correlation coefficient trix betw Stream flow and Nino4 at Aswan hydraulic station.

	WINTER	SPRING	SUMMEI	AUTUMN	ANNUAL
Winter	-0.27	-0.16	-0.24	-0.32*	-0.25
Spring	0.34**	0.19	0.37**	0.33*	0.31*
Summer	-0.22	-0.12	-0.24	-0.26	-0.19
Autumn	-0.42**	-0.23	-0.44**	-0.50**	-0.40**
Annual	-0.31*	-0.19	-0.34**	-0.40**	-0.31*

Table 2b Correlation coefficient trix betw Stream flow and Nino4 at Khartoum hydraulic station.

	WINTER	SPRING	SUMMEI	AUTUMN	ANNUAL
Winter	-0.19	-0.14	-0.28*	-0.26	-0.22
Spring	0.16	0.10	0.07	0.14	0.14
Summer	-0.19	-0.11	-0.20	-0.25	-0.18
Autumn	-0.35**	-0.20	-0.35**	-0.38**	-0.31*
Annual	-0.34**	-0.21	-0.38**	-0.41**	-0.33*

Table 2c Correlation coefficient atrix betwe Stream flow and Nino4 at Malakal hydraulic station.

	WINTER	SPRING	SUMMEF	AUTUMN	ANNUAL
Winter	-0.27	-0.07	-0.22	-0.33*	-0.20
Spring	0.12	-0.01	0.05	0.09	0.04
Summer	0.16	0.18	0.23	0.20	0.22
Autumn	-0.08	-0.01	-0.12	-0.13	-0.07
Annual	0.02	-0.03	-0.04	-0.03	-0.03

**** significant at 99% confidence level**

*** significant at 95% confidence level**

c) Nino3.4

Correlation coefficients between strea w (SF) and Nino3.4 at three hydraulic stations (Aswan, Kharto m, and M l) are presented in table 3a, b, and c. There is inverse relation etween w easons of SF and autumn at all hydraulic stations. Also, wi ter seaso ibits inverse relation with summer Nino3.4 at Khartoum, a d with w Nino3.4 at Malakal. While positive correlations between sp ing SF a nter, summer, and autumn Nino3.4 at Aswan hydraulic statio is found. ner season of SF exhibits an inverse relation with summer, autu nn, and a Nino3.4 at Aswan hydraulic station. Also, autumn and annual of SF exl an inverse relation with all seasons and annual Nino3.4 with a exceptio pring Nino3.4 at Aswan and Khartoum hydraulic stations.

These results are agreement with r esearchers such as Ogallo (1986), Ropelewski and Halpert 1987) an pson et al. (1993). Eltahir (1996) found that 25% of the natu l variabil the annual f ow of the River Nile is associated with El Nino oscillation e natural variability in the

autumn Nino3 are positive, they correlated only at Aswan hydraulic station. Summer season of SF has negative correlation with all seasons and annual at Aswan and autumn at Khartoum hydraulic stations. Autumn and annual SF of Aswan and Khartoum hydraulic stations are negative correlated with all seasons and annual Nino3.

Table 1a Correlation coefficient matrix between Stream flow and Nino3 at Aswan hydraulic station.

	WINTER	SPRING	SUMMER	AUTUMN	ANNUAL
Winter	-0.31*	-0.33*	-0.33*	-0.31*	-0.33*
Spring	0.23	0.15	0.28*	0.31*	0.25
Summer	-0.32*	-0.36**	-0.42**	-0.35**	-0.40**
Autumn	-0.42**	-0.30*	-0.47**	-0.52**	-0.46**
Annual	-0.36**	-0.35**	-0.42**	-0.42**	-0.43**

Table 1b Correlation coefficient matrix between Stream flow and Nino3 at Khartoum hydraulic station.

	WINTER	SPRING	SUMMER	AUTUMN	ANNUAL
Winter	-0.40**	-0.30*	-0.34**	-0.36**	-0.35**
Spring	-0.03	0.04	0.00	0.09	0.04
Summer	-0.16	-0.21	-0.26	-0.28*	-0.24
Autumn	-0.33*	-0.17	-0.44**	-0.45**	-0.39**
Annual	-0.33*	-0.26	-0.47**	-0.47**	-0.43**

Table 1c Correlation coefficient matrix between Stream flow and Nino3 at Malakal hydraulic station.

	WINTER	SPRING	SUMMER	AUTUMN	ANNUAL
Winter	-0.35**	-0.22	-0.27	-0.32*	-0.27
Spring	0.05	-0.05	0.12	0.15	0.06
Summer	0.06	0.03	0.11	0.17	0.11
Autumn	-0.12	-0.17	-0.15	-0.08	-0.13
Annual	-0.05	-0.13	-0.02	0.02	-0.05

**** significant at 99% confidence level**

*** significant at 95% confidence level**

b) Nino4

From table 2a, b, and c one can find that winter season of the stream flow (SF) for Aswan and Malakal is negative correlated with autumn Nino4, while spring SF and winter, summer and autumn Nino4 are positive correlated only at Aswan hydraulic station. But, inverse relation between autumn and annual SF and all seasons and annual Nino4 with an exception of spring Nino4 is found.

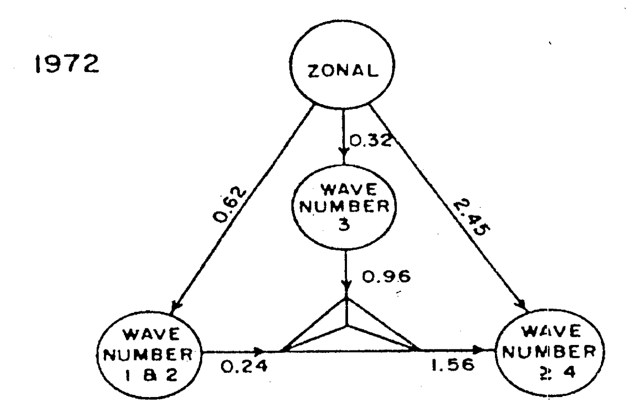


Figure 4b. Baratrobic energetic between four different scales, i.e., zonal long wave (wave number 1 and 2), wave number 3 shorter waves (After kanamitsu and Krishnamurti, 1978).

RESULTS AND DISCUSSIONS

Correlation between Stream flow and El Nino

El Nino refers to the occasional "anomalous" warming of the eastern tropical Pacific Ocean but is commonly linked to a basin-scale warming extending from the coast of South America to the International dateline. La Nina refers to the opposite phase where sea surface temperatures (SSTs) are well below average. Both events are named only when the SST departures from average are reasonably large. A common working definition is that if the SSTs depart from the normal by more than $0.5^{\circ} C$ for more than 6 consecutive months over some region then an event is considered to have taken place, Trenberth and Hurrell, (1994). Both El Nino and La Nina events are a normal part of the behavior of SSTs in the tropical Pacific where the main variations occur through atmosphere-ocean interactions on inter-annual time-scales, Philander (1990). It is the basin-scale phenomenon, however, that is linked to global atmospheric circulation and associated weather anomalies.

Tables 1, 2, and 3 show the correlation matrix between Nino3, Nino4, and Nino34 and stream flow respectively at three hydraulic stations (Aswan, Khartoum, and Malakal) over River Nile.

a) Nino3

From table 1a, b, c one can see that most significant relation between Nino3 and stream flow (SF) are negative relation (negative relation means that a decrease in stream flow may occur with strong Nino and vice versa for positive relation). Correlation coefficients between winter SF and all seasons and annual Nino3 are negative at Aswan and Khartoum hydraulic stations, but at Malakal it correlated with winter and autumn Nino3. While spring SF and

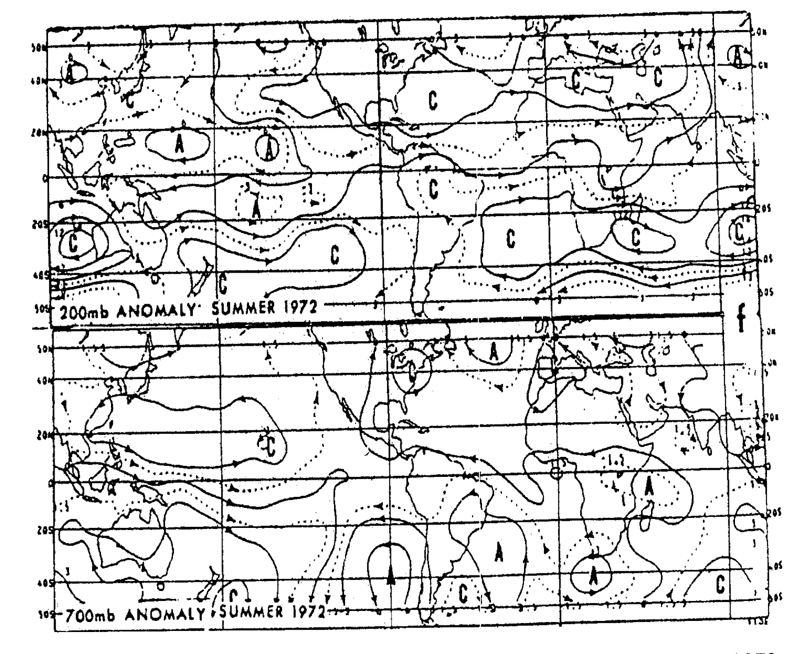


Figure 3. The 200 and 700 hpa circulation anomalies for summer 1972. Contour interval is $6?10^6 m^2/s$ at 200 hpa and $3?10^6 m^2/s$ at 700 hpa. Intermediate contours are indicated by dashed lines. Letters "A" and "C" indicate center of relative anticyclonic and cyclonic circulations. Contour interval of $6?10^6 m^2/s$ per 10 of latitude corresponds to an anomalous of 5.4 m/s (After Krueger and Winston, 1975).

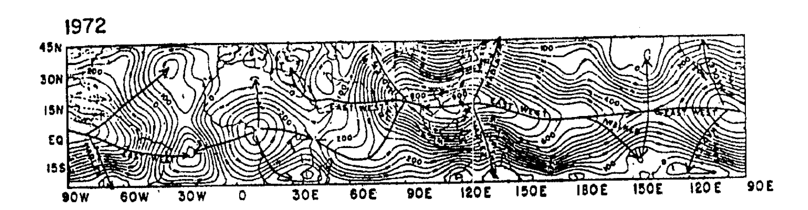


Figure 4a. Northern summer mean velocity potential fields for drought year 1972. Units $?10^6 m^2/s$. (After kanamitsu and Krishnamurti, 1978).

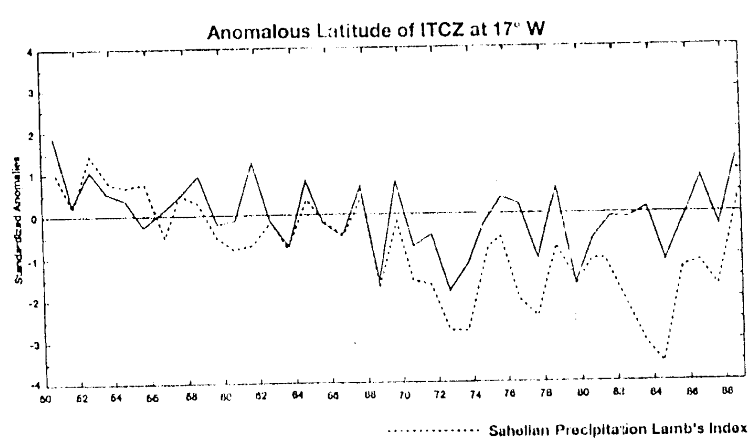


Figure 2. Sahelian rainfall variability is closely linked to the latitudinal position of the Inter-tropical Convergence Zone (ITCZ).

The year 1972 is well recognized as one of the peak periods of the well known Sahelian drought as well as the remarkbale low River Nile floods. The drought during 1972 was characterized by anomalous circulation of global scale. The following findings have been reported by many authors, Krueger and Winston (1975), Kanamitsu and Krishnamurti (1978), and Lasheen (1990):

1. The high level circulation of 200 hpa level over central Pacific has easterly anomalies along the equator and strong westerly anomalies at approximately $25^{\circ} N$ and $25^{\circ} S$ (upper panel of Fig.3). This is due to the presence of two anticyclonic circulation anomalies flow centered at $15^{\circ} N$ and $15^{\circ} S$ approximately.
2. The low level South Pacific and South Atlantic anticyclones were situated south of their normal position. Accordingly the low level (700 hpa) traded wind has been found weaker than normal over most of the tropical Pacific Ocean from southeast Asia to near $120^{\circ} W$, (lower panel of Fig. 3).
3. Over the tropical region of Atlantic Ocean, African continent and Arabian Sea, it has been found that the upper level attained westerly anomalies (upper panel of Fig.3),while the lower level has easterly anomalies (lower panel of Fig.3).This illustrate that the tropical easterly jet was weaker than normal over Africa. Asiatic monsoon was weaker than normal in both the lower and upper levels.
4. The Asiatic monsoon was shifted in summer 1972 southeastward.
5. The Walker (Hadley) type circulation was weaker (stronger) in summer 1972. The divergence circulation in the upper air (200 hpa) originating from Cameron in West Africa was very strong (Fig. 4a).
6. In 1972 summer there were a number of small-scale features and a lack of large-scale organization in the broad of the upper air easterly belt along the Tropical easterly jet, Kanamitsu and Krishnamurti (1978).
7. During summer 1972 the long waves were not well developed and zonal flows were the major energy source for long as well for short wave i.e. barotrobically unstable Jet (see Fig. 4b).

Several observations have shown variations of circulation between wet and dry years. Kidson (1977), Newell and Kidson (1979; 1984) have reported that, during dry years the Tropical easterly jet (TEJ) is weaker and the African easterly jet (AEJ) is stronger. Kanamitsu and Krishnamurti (1978) have shown a waking of the TEJ and stronger westerlies in the central Pacific Ocean when they compared the circulation of the dry year 1972 to the normal year 1967. The decrease of easterly wind occurs not only over Africa but also over the Atlantic Ocean, Laval and Picon (1986). It has been pointed out that statistics linkage between rainfall fluctuation and zonal circulation in tropical west Africa (AEJ; TEJ) were nothing less than simple covariations, and had by no means causal aspects, Leroux (1988). In return when one considers the Hadley cell evolution (north and south) on Africa, it is noticed that the duration of amount of precipitation depends on location of the inter-tropical convergence zone (ITCZ). When the ITCZ climbs up to $20^{\circ} N$, whether the excess is global for the continent (if the progress is slow) or the situation is almost normal (if the progress is moderate, i.e. five months on the way there, and three months on return). It could happen that the ITCZ does not exceed the southern regions of the continent. In that condition there is excess in south and deficit in the north. The opposite occurs (excess in the north and shortage in the south) when the ITCZ advances rapidly northwards and stays for a long time in that position. Also, according to Hastenrath (1990), displacement of the ITCZ is a dominant factor for Sahel drought, on both the inter-annual and decadal time scales.

It is noticed that the years when the southern oscillation (SO) is negative (El Nino phenomenon) there is rainfall shortage in the Sahel and conversely, Carnier (1979). Changes in atmospheric circulation accompanying El Nino induce changes in cloud cover and evaporation which, in turn, increase the net heat flux entering these remote Ocean, Klein et al., (1998). Also, they found, in the tropical North Atlantic, a weakening of the trade winds during El Nino reduces surface evaporation and increases sea surface temperatures (SSTs). At a seasonal time scale the strengthening of geopotentials in south Atlantic are followed by heavy precipitation on the continent with a delay of two or three months, Boko (1989). This latency is important enough to bring forth forecasts at national or regional space-scale, and in return to master pernicious consequences. Tourre and Lamb (1997) have found Sahelian rainfall variability is closely linked to the latitudinal position of the ITCZ and the meridional sea surface temperature SST gradient in the tropical Atlantic. Also, they found that the latitude of the ITCZ depends upon both local condition and remote forcing. The North Atlantic Oscillation (NAO) also generates a component of climate variability over the northern rim of the continent and over Western Africa, see figure 2. The known change in the north-south inter-hemispheric gradient of sea surface temperature (SST) has accompanied climate fluctuation not just in the Sahel, but also through much of the tropics, Ward (1998). Nevertheless these observations do not explain the cause of the variations in the global transfer of the planetary circulation system. But they prove that it is important to search for climatic fluctuation causes as forming an integral part of the planetary scale systems.

the Azores high-pressure region (Ponta Delgada). It is a dominant mode of atmospheric behavior in the North Atlantic sectors.

Three types of Atlantic sea surface temperature may affect stream flow over River Nile. These types are North Atlantic Ocean (NA), which lies between ($5^{\circ} N ? 20^{\circ} N$) latitude, ($60^{\circ} W ? 30^{\circ} W$) longitude, Southern Atlantic Ocean (SA) in the area between ($0 ? 20^{\circ} S$) latitude, ($30^{\circ} W ? 10^{\circ} E$) longitude and global Tropical Atlantic Ocean (TA), from $10^{\circ} S$ to $10^{\circ} N$ latitude and from 0 to 360 longitude.

A large part of the results presented are based on classic correlation analysis, so called correlation matrix, which consider the "similarity" between the variability of two variables Mood et al., (1974). In this case, the variables are the average seasonal (46 seasons) discharge at three hydraulic stations, the average seasonal sea surface temperature over Pacific Ocean (El Nino), sea surface temperature over Atlantic Ocean (North Atlantic Ocean, South Atlantic Ocean, and average monthly tropical Atlantic Ocean) and Southern Oscillation.

In testing the statistical significance of correlation coefficient (r) for the null hypothesis of randomness, we may use the exact one-tail significance points. When number of points (N) is greater than about 40, it will generally be sufficient to base the significance test on a desired probability point of the Gaussian (normal) distribution. If t_g is the value of the standard deviate in the Gaussian distribution corresponding to the desired significance point of r we may use this value of t_g in the equation $(r)_t ? \frac{?1 ? t_g \sqrt{N ? 2}}{N ? 1}$. For all tables from 1-8 are significance at 99% confidence level with (**) sign and significance at 95% confidence level with (*) sign. The values of correlation less than 30% and sign with (*) are in the lower boundary of 95% significance confidence level.

Circulation control

Changes in atmospheric circulation patterns are considered as an indicator of possible climate change. Obviously, a close relationship exists between type of atmospheric circulation and the prevalence of rainfall. There is observational evidence that the frequency of certain European circulation patterns has changed during the last 30 years, Zwart (1992; 1993). General Circulation Models indicate changes in the Northern Hemisphere Storm tracks, Hall et al. (1994). While the important role of land-ocean contrast (LOC) in the mean atmospheric circulation is well-known, can significantly influence the anomaly circulation, Joseph and Goswami (1999). A latitudinal LOC, with a land mass in the northern hemisphere (north of $10^{\circ} N$), tends to shift the reion of maximum precipitation slightly north of the equator with accompanying steeper gradients near the land-ocean boundary. Also, it is found that both latitudinal and longitudinal effects of LOC are important aspects of the tropical anomaly circulation.

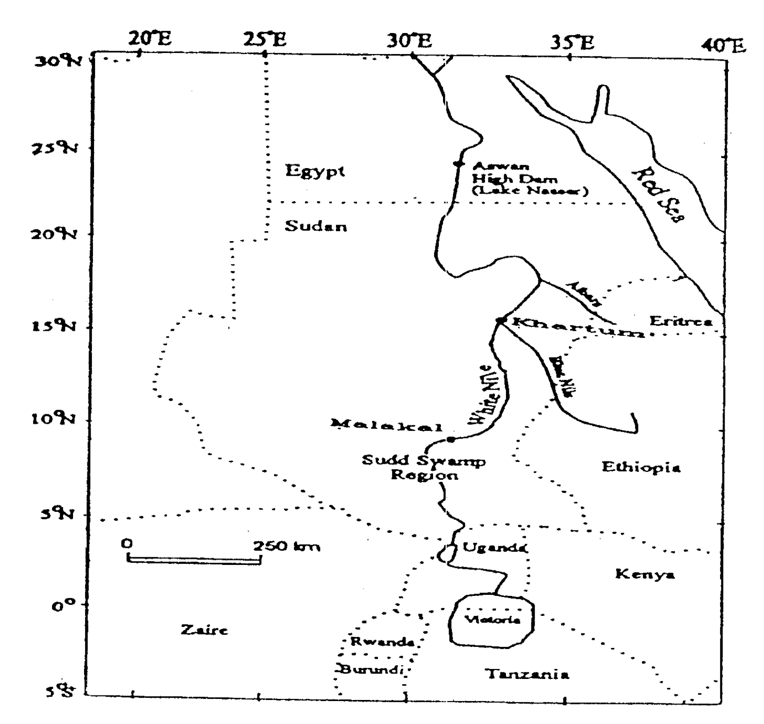


Figure 1. Location of t he three hydraulic stations over River Nile, Aswan, Khartum, and Malakal.

There is more than one type of El Nino depending on the area, which they occupy. In this study we used three types of them, which may influence stream flow over River Nile. These types are Nino3, which covers the area lies between $5^{\circ} N ? 5^{\circ} S$ latitude and $150^{\circ} W ? 90^{\circ} W$ longitude, Nino4, which covers the area lies between $5^{\circ} N ? 5^{\circ} S$ latitude and $160^{\circ} E ? 150^{\circ} W$ longitude and Nino 3.4, which covers the area lies between $5^{\circ} N ? 5^{\circ} S$ latitude and $170^{\circ} W ? 120^{\circ} E$ longitude.

The nature of the Southern Oscillation can be seen from the inverse variations in pressure at Darwin ($12.4^{\circ} S, 130.9^{\circ} E$) in northern Australia and Tahiti ($17.5^{\circ} S, 149.6^{\circ} W$) in the South Pacific Ocean whose annual mean pressure are correlated at –0.79, Trenberth (1984). These two stations can be optimally combined into a SO index, $SOI ? T_N ? D_N$ where T and D refer to the departure from the long-term monthly mean sea level pressures at Tahiti and Darwin, respectively, and the subscript N refers to an appropriate normalization.

NAO is a large-scale alternation of atmospheric mass with centers of action near the Icelandic low-pressure region (Stykkisholmur/Reykjavik) and

Many researchers investigated relationship between Sahelian rainfall, and consequent stream flow over River Nile, and Atlantic Ocean sea surface temperature. Lough, (1986), and Ropelewski and Halpert (1987) found that inter-annual variations in Sahelian rainfall have been linked to Atlantic Ocean sea surface temperature anomaly pattern. Sahelian region extended from $12.5^{\circ} N$? $20^{\circ} N$ and from the Atlantic to the Red sea, Folland et al., (1991). Rainfall in the Sahel is seasonal, with little falling outside the period May to October. The deficient precipitation in the Sahel tends to be associated with anomalous cold SST in the south Atlantic, Hastenrath, (1990). Tropical Atlantic SSTs and the latitudinal position of the inter-tropical convergence zone (ITCZ) are connected with Sahelian rainfall variability, Fourre and Lamb (1997) and Ward (1998). Sea surface temperature anomalies in the tropical Atlantic can lead to shifts in climatic patterns over Africa. Also, it has a significant impact on the position and intensity of the ITCZ, which in turn influence the rainfall over the Sahel in Africa, WCRP (1997).

In this paper, an attempt is made to examine the relationships between mean natural stream flow for three irrigation stations over River Nile and global climate events. In Section 2 data and Methodology are presented. While relationship between type of atmospheric circulation and the prevalence of rainfall is shown in section 3. Results and discussion are presented in section 4. In the last section conclusion is presented.

DATA AND METHODOLOGY

Monthly mean stream flow observations at three stations situated in the River Nile were used: Aswan ($24.0^{\circ} N, 32.9^{\circ} E$) from 1950 to 1996, Khartoum ($15.6^{\circ} N, 32.6^{\circ} E$), and Malakal ($9.5^{\circ} N, 31.6^{\circ} E$) from 1950 to 1996. The data set of the stream flow over River Nile has supplied by the Ministry of Water Resources of Egypt. There are two primary sources of the main River Nile channel, the Blue Nile and the White Nile. Combining with these sources to augment the Nile's flows is three other major tributaries: Bahr El Ghazal, River Sobat and River Atbara fig. 1. The annual yield of the Blue Nile at Khartoum is around 54-milliard m^3 per year. The total amount of water provided by the White Nile at Malakal is on the average 29-milliard m^3 per year, distribution is relatively uniform throughout the year. The amount of water arriving to Aswan amounts to an estimated average of 84-milliard m^3 per year.

Monthly data of Southern Oscillation, North Atlantic Oscillation, and global sea surface temperature (SST) anomalies (El Nino, Northern Atlantic Ocean (NA), Southern Atlantic Ocean (SA), and Tropical Atlantic Ocean (TA) during the period from 1950 to 1996 were obtained from National Center for Atmospheric Research (NCAR).

especially of Egypt and Sudan, the two major downstream nations in the Nile Basin.

Natural factors include changes in precipitation regimes particularly over the headwaters of the Blue and/or White Niles, changes in evaporation, and changes in vegetation in the catchments, which affect runoff. Such changes, however, may also be anthropogenic in origin with precipitation being affected by, for example, human-induced land covers change, Nicholson (1988). Additional anthropogenic factors affecting the total natural stream flow include the extraction of water for domestic, agricultural, industrial, or power generation purposes. On the global scale, decadal to century-scale variability and change in the climatic system are determined by natural e.g. solar cycle; Kerr (1996), Crowley and Kim (1996) and anthropogenic factors e.g. greenhouse gases and aerosols; IPCC (1990, and 1995). The response of the climatic system is manifested by complex processes in the ocean and the atmosphere, which are well known such as El Nino, Southern Oscillation (SO), Quasi-biennial Oscillation (QBO), Madden-Julian (MJ), North Atlantic Oscillation (NAO), and variations of sea surface temperature over Atlantic Ocean, etc. There is no doubt that all of these processes, which are partly characterized by teleconnections patterns, affect the precipitation and stream flow over River Nile.

Link between El Nino, Southern Oscillation and large-scale precipitation patterns have been examined since the earliest studies of this phenomenon. Indeed, the pioneering studies by Walker (1923, 1924, 1928) and Walker and Bliss (1930, 1932, 1937), which first documented ENSO on a global scale, were motivated by attempts to understand and predict variations in Indian monsoon rainfall and then were expanded to studies of precipitation around the globe. Long ago the cause of drought in that region was hypothesized to be a simple southward. The possible relationships might exist between a climatic event, termed El-Nino Southern Oscillation, ENSO, phenomenon, and other climatic anomalies worldwide, Ropelewski and Halpert (1987). Ropelewski and Halpert (1987) and also, Simpson et al. (1993) indicate that oscillations in the state of the ocean-atmosphere system in the Pacific region (ENSO) are related to inter-annual fluctuation of rainfall and river flow in several regions of the world. Ogallo (1985) illustrates the negative correlations between rainfall over many parts of Eastern Africa and ENSO event. However, the relationship between ENSO and rainfall over that portion of the Ethiopian Plateau, which contribute to River Nile inflows, has not been thoroughly investigated. Also, Eltahir (1996) and Wang and Eltahir (1998) found that significant relationship between stream flow over River Nile and El Nino and Southern Oscillation.

The North Atlantic Oscillation (NAO) is most pronounced in winter but detectable as a characteristic pattern in all months. The winter NAO pattern contributes the largest fraction of the Northern Hemisphere temperature variability of any mid-latitude or tropical mode of fluctuation. NAO fluctuations are found in the patterns of precipitation in between Mediterranean Eurasia/Africa and the eastern United States as well as storminess over the ocean and adjacent land areas.

ASSOCIATIONS BETWEEN STREAM FLOW OVER RIVER NILE AND GLOBAL CLIMATIC EVENTS

H.M. Hasanean

Cairo University, Faculty of Science, Dept. of Astronomy and Meteorology, Giza, Egypt. E.Mail: Hasanean@Sci-Astro.cairo.eun.eg

ABSTRACT

The seasonal and annual patterns of stream flow at three hydraulic stations over River Nile are analyzed in relation to El Nino, Southern Oscillation, North Atlantic Oscillation, and Atlantic sea surface temperature (north Atlantic, NA, southern Atlantic, SA, and Tropical Atlantic, TA) using correlation matrix. The impacts of these processes on natural stream flow over River Nile were investigated. The natural stream flow over River Nile depends mainly on Etheopian rainfall. The duration of amount of rainfall depends upon both location of the inter tropical convergence zone (ITCZ) and the meridional sea surface temperature (SST) gradient in the tropical Atlantic. The variation of the inter-hemispheric SST gradient has a significant impact on the position and intensity of the Inter-tropical Convergence Zone (ITCZ), which in turn influences the rainfall over the Sahel in Africa and consequent by the stream flow over River Nile.

Inverse relationships are found between seasonal, and annual stream flow over River Nile to El Nino. Positive relationships between stream flow and Southern Oscillation are found. The influence of North Atlantic Oscillation (NAO) and sea surface temperature of North Atlantic Ocean (NA) on stream flow over River Nile are much weaker. Southern Atlantic Ocean (SA) and Tropical Atlantic Ocean (TA) have similar to El Nino influence on stream flow over River Nile. This indicates inverse relationships with stream flow. Unlike other seasonal and annual relationship, the spring season of stream flow indicates positive relationships with El Nino and sea surface temperature of Atlantic Ocean.

INTRODUCTION

Over the last two decades dramatic climatic events have been reported over much of the globe. There have been floods in U.S.A., Latin America Cuba, Ecuador, Peru, Bolivia, Polynesia and drought in NE Brazil, much of Africa, and most of Australia and Melanezia. They have brought considerable loss of life, much suffering and economic losses.

River Nile is the major source of water for Egypt. The Nile basin encompasses nine countries in northeast Africa and has a surface area of just over four million square km. The River Nile itself is 6640 km from source to mouth, the longest in the world, Figure 1. The population of the Nile basin is about 180 million of whom at least 50% are heavily dependent on the Nile waters for their economic and domestic existence. The reliability of Nile discharge is therefore fundamental for the well being of northeast Africa and

التباين النوعى ومظهرية الغطاء النباتى بالأراضى الرطبة فى واحة سيوة

أحـــمد عبد اللطيف الخولى* و عبد الحـــميد عبد الفتاح خضـــر**

*رئيس وحدة البيئة النباتية والمراعى - مركز بحوث الصحراء - المطرية - القاهرة

**قسم النبات - كلية العلوم بدمياط - جامعة المنصورة - دمياط الجديدة - ص ب ٣٤٥١٧

تعتبر هذه الدراسة محاولة لتقييم التباين النوعى ومظهرية الكساء النباتى بالأراضى الرطبة فى واحة سيوة ، وكذلك استنتاج أهم العوامل البيئية المؤثرة على توزيع النباتات البرية .

تم تقسيم ٣٦ موقعا ممثلة بنباتات الأراضى الرطبة فى واحة سيوة إلى أربعة مجاميع نباتية تسودها سبعة أنواع نباتية باستخدام برامج التصنيف الحديثة (TWINSPAN & CANOCO). كانت النباتات السائد لتلك المجاميع هـــى: السمار المــر *Juncus rigidus*، العـــاقول *Alhagi maurorum*، الخطـــب الأحمـــر *Arthrocnemum macrostachyum*، البوص *Phragmites australis*، الديس *Scirpus littoralis*، البردى *Typha domingensis*، نخشوش الحوت *Ceratophyllum demersum*.

توصلت الدراسة إلى أن أهم العوامل المؤثرة على توزيع النباتات البريه بالأراضى الرطبة فى واحة سيوة هى ملوحة التربة ومستوى الماء الأرضى وكذلك نسبة الحصى بالتربة. كّذلك تم تفسير المدى البيئى للأنواع السائدة والـــمرافقة علـــى محاور التقسيم.

توصلت الدراسة أيضا إلى قلة التباين النوعى وعدم وجود اختلاف معنوى لمقاييس التنوع المختلفة بين المجـــاميع النباتية. تم مناقشة نتائج الدراسة مع الدراسات السابقة وكذلك الأسباب التى أدت إلى اختفاء بعض الأنواع النباتية (مثـــال عشيرة النتريح *Cladium mariscus*) التى كانت سائدة من قبل فى واحة سيوة.

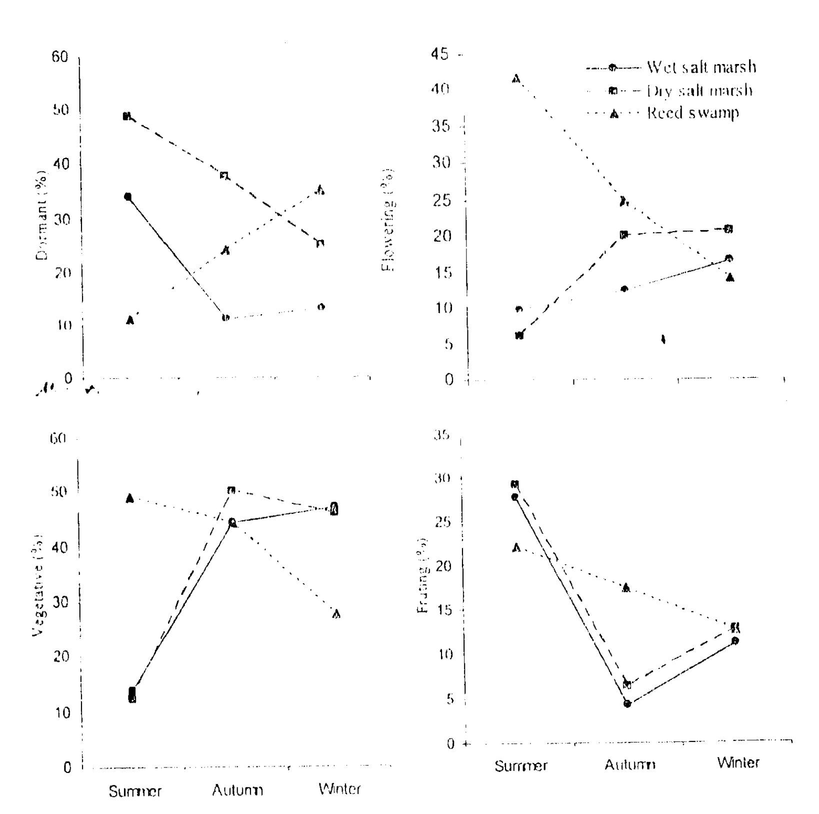
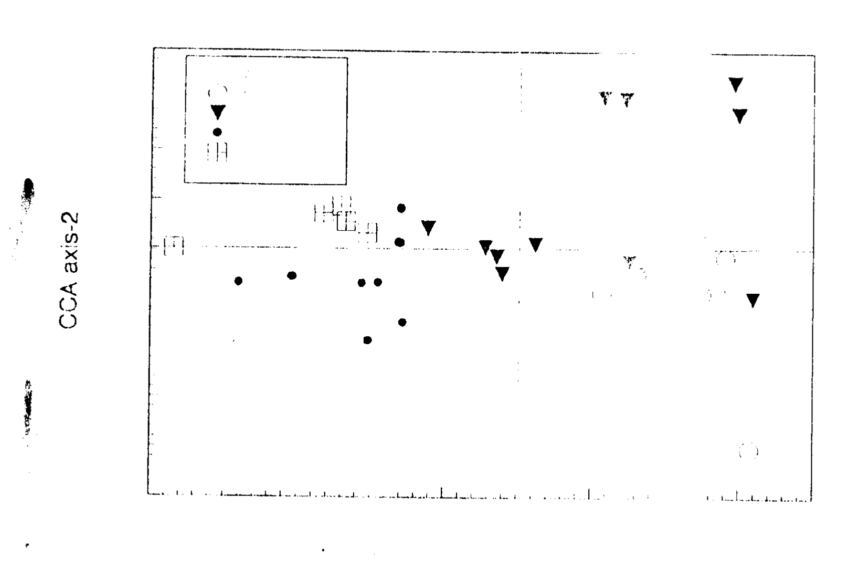


Figure 5. Seasonal variation in the phenological state (%) of wetland vegetationin Siwa Oasis.

188


CCA axis-2

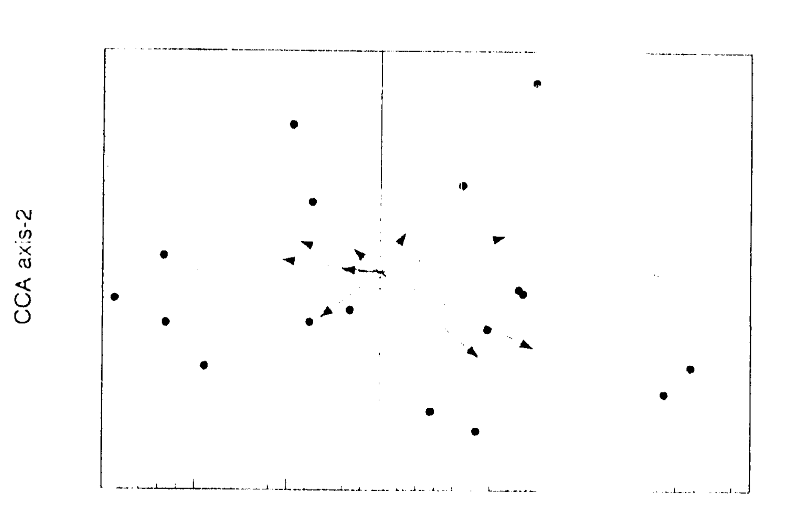

CCA axis-2

Table 2. Means of 9 environmental variables and the analysis of variance (ANOVA) between groups (A-D). The diversity indices of the studied groups are shown.

	Vegetation groups					
	A 5	B 17	C 9	D 5	F_{ratio}	p-value
Environmental variables						
Gravel %	21.10	23.16	11.07	10.42	5.01**	0.01
Sand %	71.74	65.41	55.91	56.94	2.36NS	0.09
Silt %	4.68	4.53	5.96	5.28	0.71NS	0.55
Clay %	14.38	17.89	17.49	16.06	0.12NS	0.95
pH	7.52	7.68	7.89	7.79	1.33NS	0.28
EC (mmohs/cm)	90.36	65.76	35.09	13.80	4.94**	0.01
Organic carbon %	0.09	0.09	0.05	0.11	0.18NS	0.91
$CaCO_3$ %	16.73	19.71	31.68	30.94	1.85NS	0.16
Water table (cm)	78.4	23.65	0.00	0.00	13.47***	0.000
Diversity indices						
Richness	4.60	3.47	3.66	3.20	1.01NS	0.40
Shannon index (H')	0.98	0.78	0.86	0.88	0.58NS	0.63
Hill's numbers						
N1	2.86	2.29	2.52	2.49	0.72NS	0.55
N2	2.57	2.00	2.18	2.16	0.42NS	0.74
Evenness						
E1	0.67	0.71	0.69	0.83	0.92NS	0.44
E2	0.64	0.72	0.70	0.82	0.98NS	0.42

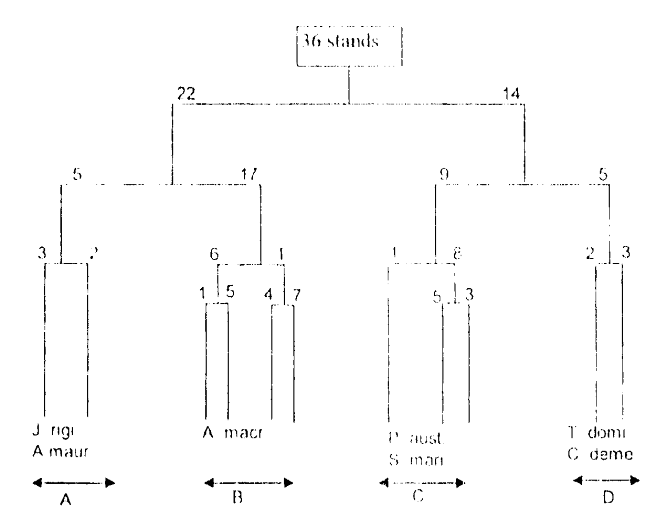


Figure 2. TWINSPAN dendrogram of 36 stands based on the importance values of wetland plant species in Siwa Oasis. The indicator species of each group are shown.

Table 1 Mean importance values (IV) of plant species in the different vegetation groups of the wetland habitats in Siwa Oasis. The indicator species are shown in bold

Species	IV	Species	IV
Group A		**Group B**	
Juncus rigidus	**129.2**	*Juncus rigidus*	124.1
Alhagi maurorum	**63.2**	*Pharagmitis australis*	98.7
Pharagmitis australis	46.4	***Arthrocnemum macrostachyum***	**37.9**
Imperata cylindrica	14.6	*Tamarix mannifera*	24.4
Inula chrithmoides	16.9	*Phoenix dactylifera*	3.9
Phoenix dactylifera	16.2	*Typha domingensis*	3.2
Arthrocnemum macrostachyum	5.8	*Inula chrithmoides*	0.8
Zygophyllum album	1.5	*Cressa cretica*	0.1
Aetheoriza bulbosa	0.5		
Group C		**Group D**	
Pharagmitis australis	**151.8**	*Pharagmitis australis*	146.8
Scirpus litoralis	**29.9**	***Ceratophyllum demersum***	**76.9**
Sonchus maritimus	12.1	***Typha domingensis***	**89.8**
Ceratophyllum demersum	5.6	*Scirpus litoralis*	52.4
Imperata cylindrica	4.0		
Samolus valerandi	3.2		
Phoenix dactylifera	2.3		
Cynanchum acutum	0.9		
Silene gallica	0.4		

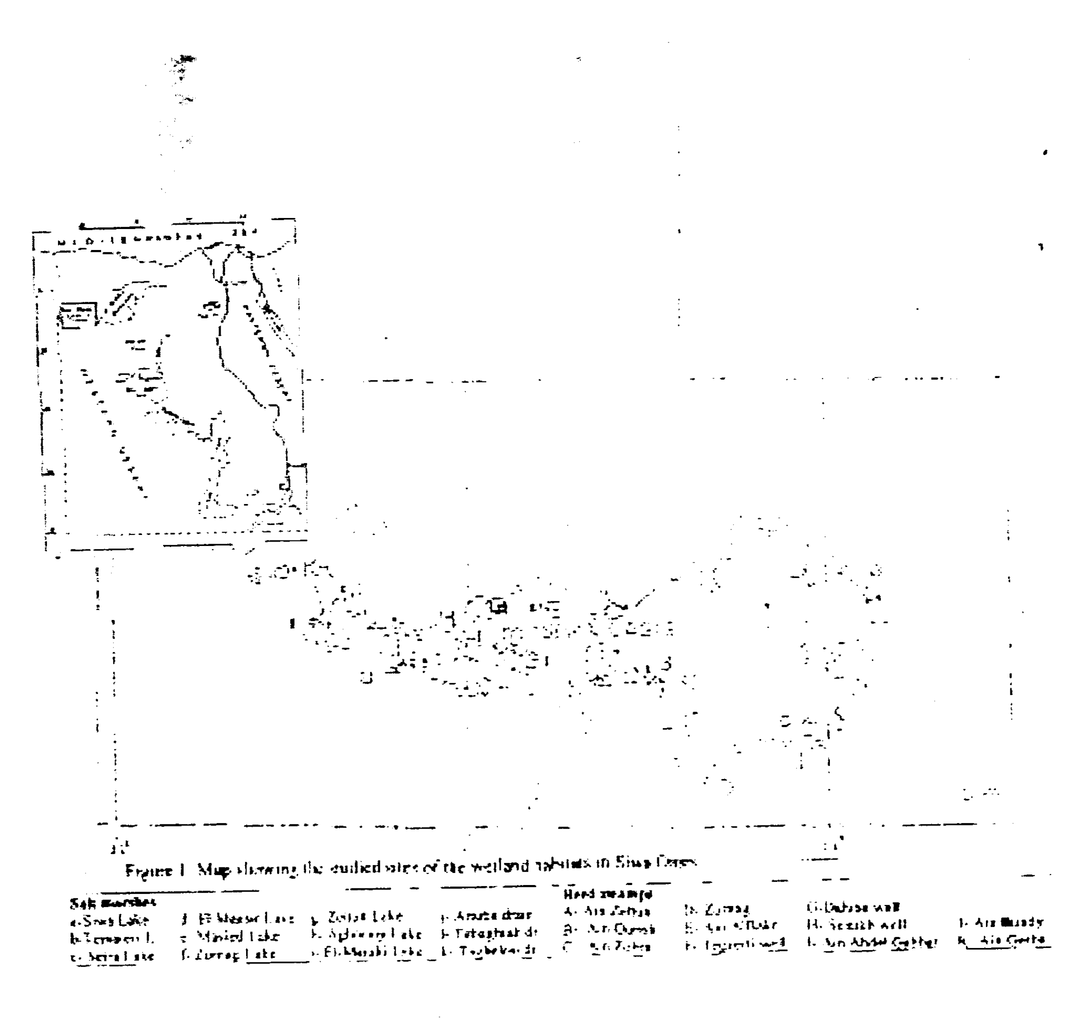


Figure 1 Map showing the studied sites of the wetland habitats in Siwa Oasis

Zahran, M.A. 1972. On the ecology of Siwa Oasis. Egypt. J. Bot.15: 223 – 242.

Zahran, M.A. and Willis, A.J. 1992. The vegetation of Egypt. Chapman & Hall, London. 423 pp.

Zahran, M.A., K.J. Murphy, I.A. Mashaly, and A.A. Khedr. 1996. On the ecology of some halophytes and psammophytes in the Mediterranean coast of Egypt. Verh. Ges. Ökol. 25: 133-146.

Zar, J.H. 1984. Biostatistical Analysis. 2nd edn. Prentice-Hall, Englewood Cliffs, 718 pp.

Zunzunegui M., Diaz Barradas M. C. and Gracia Novo F. 1998. Vegetation fluctuation in a Mediterranean dune ponds in relation to rainfall variation and water extraction. Applied Vegetation Science, 1: 151-160.

Gindy, A.R. and El-Askary, M.A. 1969. Stratigraphy, structure and origin of Siwa depression, Western Desert of Egypt. Bull. Amer. Assuc. Petrol. Geol. Vol. 53, No.3, PP. 603-625.

Hill, M.O. 1979. TWINSPAN — A Fortran Program for Arranging Multivariate Data in an Ordered Two-Way Table of Classification of Individuals and Attributes. Ithaca, NY, Cornell Univ., 90 pp.

Imbaby, N. 1977. Morphological Map of Siwa Depression (C.F. PBDSO,1989).

Jackson, M.L.1967. Soil Chemical Analysis. Hall of India Private, New Delhi, 248 pp.

Jongman, R.H., C.J.F. ter Braak, and O.F.R. Van Tongeren. 1987. Data Analysis in Community and Landscape Ecology. Pudoc (Waginengin), The Netherlands, 299 pp.

Khedr, A.A. and Lovett-Doust, J. 2000. Determinants of floristic diversity and vegetation composition on the islands of Lake Burollos, Egypt. Applied Vegetation Science, 3: 147-156.

Ludwig, J.A. and Reynolds, J.F. 1988. Statistical Ecology: a primer on methods and computing. New York: John Wiley & Sons. 337 pp.

Muller-Dombois, D. and Ellenberg, H. 1974. Aims and Methods of Vegetation Analysis. New York: John Wiley & Sons. 547 pp.

PBDSO, 1989. Project of Biological Drainge in Siwa Oasis. Arabic report Desert Research Institute. 150 pp.

Piper, C.S. 1950. Soil and plant analysis. University of Adelaide Press, Australia.

Salih, A.H. 1970. Pedological studies of Siwa Oasis. M.Sc.Thesis, Agric., Cairo Univ.

Shaltout, K. H. and El-Ghareeb, R. 1992. Diversity of the salt marsh plant communities in the western Mediterranean region of Egypt. J. Univ. Kuwait, 19: 75-84.

Shaltout, K.H., H.F. El-Kady, and Y.M. Al-Sodany. 1995. Vegetation analysis of the Mediterranean region of Nile Delta. Vegetatio 116: 73-83.

Shaltout, K.H., Sharaf El-Din, A., and A.M. El-Sheikh 1994. Species richness and phenology of vegetation along irrigation canals and drains in the Nile Delta, Egypt, Vegetatio, 118: 35-43.

Shata, A., Knetsch, G., Degens, E.T., Munnich, O. and El-Shazli, M. 1962. The geology, origin and age of the ground water supplies in some desert areas of U.A.R. ibid.,12, 61.

Täckholm, V. 1974. Students' Flora of Egypt. 2nd. edn. Publ. Cairo Univ., Beirut, 888 pp.

ter Braak, C.J.F. 1990. Update Notes: CANOCO Version 3.1. Agricultural Mathematical Group, Wageningen, 35 pp.

ter Braak, C.J.F. and Wiertz, J. 1994. On the statistical analysis of vegetation change: a wetland affected by water extraction and acidification, J. Veg. Sci., 5: 361-372.

Ungar, I. 1974. Halophyte communities of Park county, Colorado. Bull. Torrey. Bot. Club 101: 145-152.

Van der Maarel E. 1971. Plant species diversity in relation to management. In: The Scientific management of animal and plant communities for conservation (Duffy, E. &Watt A.S. eds.) Blackwell, Oxford, pp. 45-63.

around the springs. The present study revealed that *Typha domingensis* and *Ceratophyllum demersum* have limited range of distribution in the fresh and brakish water bodies of Siwa Oasis. Increases in alien or invasive species such as *Phragmites australis* can serve as indicator of wetland disturbance.

The low species richness and low diversity in the wetland habitat of Siwa Oasis may be due to the stable conditions and the fact that most of its species are highly specific to the wetland habitat, and the same species occur nearly at all sites. This means that the species replacement or biotic change is low in this environment (Wilson & Shmida 1984). Under extremely arid climate, the dominating effect of salinity decreases the number of microhabitats which are available to various species.

There are no significant changes of species diversity in the identified groups of Siwa Oasis. This contradicts the results of van der Maarel (1971) who found that the highest values of species diversity are found in the middle of environmental gradients. This contradiction may be understood if the salinity is a limiting factor throughout the whole gradient.

The phenological sequence of reed swamp species in Siwa wetland follow a similar trend of change to that observed in the Nile delta canals and drains (Shaltout et al. 1994), where most of species become dormant in winter and reach the fruiting stage in summer. The bimodality in phenological activity (fruiting stage) of halophytes in the study area points out the fact that phenology is genetically inherited character, and the life cycle of chenopodiaceae delay their flowering to autumn (Täckhom 1974).

Finally, The present study identified 4 vegetation types in the wetlands of Siwa Oasis. These types are dominated by 7 plant species namely: *Juncus rigidus, Alhagi maurorum, Arthrocnemum macrostachyum, Phragmites australis, Scirpus litoralis, Typha domingensis,* and *Ceratophyllum demersum.* Of them Five were reported by Zahran (1972) and still dominant, while the other two speeis *Scirpus litoralis* and *Ceratophyluum demersum* are not previously recorded in Siwa. The wetland species *Cladium mariscus* and *Cyperus lavigatus* were included as dominant species in the list of Zahran (1972) were not found again. Changes in hydrology and the increase in the number of lakes together with the agricultural development in Siwa Oasis may be responsible for vegetation changes in the last few decades.

REFERENCES

A.O.A.D. 1977. Arab Organization of Agricultural Development, Khartoum. study of technical and economic of Siwa Oasis project in Egypt. Arabic Report.

Anonymous 1979. Climatological Normals for the Arab Republic of Egypt up to 1975. Ministry of Civil Aviation, Cairo.

Bornkamm R. and Khel H. 1990. The plant communities of the western desert of Egypt. Phytocenologia, 19(2), 149-231.

El-Askary, M.A. 1968. Geological Studies on Siwa Depression. Western Desert, U.A.R. M.Sc. Thesis,Univ. Alex.

ordination axes (Fig. 3). Axis 1 represents a moisture and salinity gradient of the identified groups.

The biplot ordination diagram produced by the CCA is shown in Figure 4. The position of the dominant and the associated species are clear along the gradient of 9 environmental variables. The ordination diagram confirmed that the water table and the soil salinity (EC) are the most important factors affecting species distribution. *Arthrocnemum macrostachyum* and *Phragmites australis* occurred at higher gradient of the soil salinity. *Juncus rigidus* and *Alhagi maurorum* are found at intermediate level of soil salinity. The position of aquatic plants *Typha domingensis* and *Ceratophyllum demersum* are found at the lower gradient of the soil salinity.

In the reed swamp habitat, the percentage of species with vegetative, flowering and fruiting stage decreased gradually from summer to winter (Figure 5), however, the percentage of species in dormant stage increased in winter.

In the salt mash habitat, the percentage of species with vegetative, flowering increased in autumn, with peak fruiting in summer and winter. The dormant stage was high in summer.

DISCUSSION

The application of a numerical approach to data interpretation has revealed clear vegetation trends together with hypothesis on underlying environmental factors. Although poor in species, the wetland vegetation composition of Siwa Oasis, in western desert of Egypt is indicating a number of ecologically distinct vegetation groups. The objectively derived list of indicator species of these groups may be useful for use in planning development in the region.

Ordination interpretation suggests hypothesis of site salinity, the underground water table and the percent of gravel in the soil as the major controls in Siwa Oasis wetlands. Several authors showed that a lowering of the water table can cause shortage of water for certain species (ter Braak & Wiertz 1994, Zunzunegui et al. 1998). This process may be related to the disappearance of rare species due to the lowering of water table. The role of soil moisture as a key element in the distribution of the plant species in the saltmarshes is known in coastal habitats in Egypt (Zahran et al. 1990, Shaltout et al. 1995), and Winter (1990) in a Jordanian saltpan of Al Azraq Oasis. The vegetation distribution pattern in the study areas was mainly related to gradients in salinity. The distribution of inland and coastal halophytes is mainly dependent on the salinity gradient (Ungar 1974, Shaltout et al. 1995, Zahran et al. 1996, Khedr & Lovett-Doust 2000).

The multivariate direct gradient analysis (Jongman et al. 1987) has proved useful output in explaining the position of plant species along the gradient of environmental data. The distribution of the reed swamp vegetation Siwa Oasis is remarkable. Their growth was usually confined to the areas

samples were analyzed for determination of soil texture, PH, electrical conductivity (EC), organic carbon, and calcium carbonates according to (Jackson, 1967; Piper, 1950). The depth of water table in each stand of salt marshes and the depth of water in each stand of reed swamps were determined. The pH and EC of water in lakes, springs and reservoirs of the wells were measured.

Data analysis

Two-Way Indicator Species Analysis (TWINSPAN), was applied to the classification of 36 stands in the wetland habitats of Siwa Oasis, using the importance value (IV = RD+RC+RF), where RD = relative density, RC = relative cover and RF = relative frequency respectively. TWINSPAN is a divisive hierarchical programme that uses indicator species i.e., species with clear ecological preferences, to characterize and separate the classes (Hill, 1979). The one-way analysis of variance (ANOVA) test was used to compare the means of all environmental factors and diversity indices for the identified groups. All statistical treatments followed Zar (1984), using student SYSTAT 7.0.

Canonical Correspondence Analysis (CCA), (Jongman et al. 1987), was used to ordinate vegetation with the environmental variables. The computer program CANOCO 3.12 (ter Braak, 1990) was used for all ordinations.

RESULTS

The TWINSPAN analysis resulted in the distinction of 4 vegetation groups (A-D) in Siwa Oasis wetland habitats (Figure 2). These groups showed a zonation pattern based mainly on the soil salinity and underground water table. The importance values (IV is out of 300) of the dominant and associated species are presented in table 1.

Group A is confined to the dry salt marsh in relatively elevated sites around the lakes and springs. The dominant species are *Juncus rigidus* (IV = 129.2) and *Alhagi maurorum* (IV = 63.2). Group B occupied the wet salt marshes which is permanently wet. *Arthrocnemum macrostachyum* (IV = 37.9) is the dominant species. Group C is represented by stands along the margins of fresh and saline water habitats. The indicator species are *Phragmites australis* (IV = 151.8) and *Scirpus litoralis* (IV = 29.9). Group D is confined to the fresh water habitats. *Typha domingensis* (IV = 89.8) and *Ceratophyllum demersum* (IV = 76.9) are the indicator species.

Of the 9 edaphic components analysed (Table 2), only soil salinity, gravel (P<0.01), and the underground water table (P<001), are significant among the vegetation groups. Group A had the highest mean values of EC (90.36 mS/cm) and the water table (78.4cm). The highest mean value of gravel percentage was recorded in the stands of group B (23.16%).

The canonical correspondence analysis (CCA) produced a clear separation of the wetland stands into defined groups along the first two

4) gravel desert. The Salt marsh habitat of Siwa Oasis is represented in areas adjacent to lakes where water comes from the lateral seepage of lakes water and the underground water and in inland areas around springs where the water-table is very shallow (or exposed). Under the prevalent climatic aridity, there is high evaporation of soil water and accumulation of salts in the surface layers of soil (Zahran, 1972). Also, the salt marshes are occurred in the lands adjacent to the drains. The reed swamps vegetation is well represented in the shallow water or in the terrestrial borders of the lakes of Siwa (Zahran and Willis, 1992). Also, reed swamps vegetation is occurred in the reservoirs of the springs and the artasien wells, where the water is fresh to slightly brackish.

The pattern of wetland vegetation in Siwa Oasis is unlike that of the Mediterranean coastal wetlands of Egypt (Shaltout & El-Ghareeb 1992, Shaltout et al. 1995, Zahran et al. 1996, Khedr & Lovett-Doust 2000). Generally, as suggested by Bornkamm and Khel (1990) that the area between 28° N and 30° N, Where Siwa exist, is extremely arid desert zone with completely contracted vegetation and covers not more than 1% of the landscape.

The aim of this study was to describe the effect of environmental factors on the diversity of plant species and to evaluate the phenological of the vegetation in the wetland ecosystems of Siwa Oasis.

MATERIALS AND METHODS

The study area of the salt marshes covered 21 sites including: 13 sites adjacent to the lakes of Siwa, El-Maraqi, El-Zeitun, Timeira, Setra, El-Maasir, Mesaied, Aghormy and Temaierr; 4 sites around the springs of Qurishet, Zumag, Mimi and Tebaghbagh and 4 sites adjacent to the drains of Altobo, El-Gari, Tagharghart and Taghelsi (Fig. 1).

The reed swamp vegetation is represented by 15 stands: 8 stands in the reservoirs of the springs of Ain Zeitun, Zohra, Al-Bakar, Bundy, Abdel-Gabbar, Gerba, Zumag and Mimi; 6 stands in the reservoirs of the artasian wells of Selaikh, Meshendet, Dehaiba, El-Gari and Tegzerti and one stand in the terrestrial border of Siwa lake (Fig. 1). In each stand, a list of species was recorded and 25 randomly quadrats (1X1 m) were made. According to Mueller-Dombois and Ellemberg (1974), species density was assessed per unit area, frequency was calculated and the plant canopy cover as percentage of ground surface was determined by the line intercept method. Five lines intercept transects (50 m length), randomly placed within every site. The sum of the relative density, relative frequency and relative cover gave the importance value for different species (Ludwig &Reynolds, 1988). The phenological status of plant species in all stands representing the different habitats was recorded during three seasons (summer, autumn and winter).

Three soil samples (0-20 cm depth) were collected from each stand. Samples of each stand were mixed together to form one composite sample. All samples were brought to laboratory after collection, air dried and sieved through a 2 mm sieve to get rid of debris and coarse gravel. These air-dried

INTRODUCTION

The western desert of Egypt covers about two-third of Egyptian area. It is characterized by large depressions and oasis which cover about 36% of the western desert of Egypt. Siwa Oasis occupies a depression in the northern part of Egypt situated between longitude 25° and 26° E and latitude 29° and 30° 30' N and about 300km south of the Mediterranean coast. It extends in an east-west direction with a length of about 80 km and maximum breadth of about 26 km. The total area of Siwa is about 1000km (Zahran, 1972; PBDSO, 1988). The depression of Siwa oasis lies from 10 to 17m below sea level. The bottom of the depression consists of many lakes or marshes (EL-Askary, 1968). The previous geomorphological studies divided Siwa Oasis into twelve basins (Imbaby, 1977). The sediments of salt marshes and Sabkhahs belong to submiocene. These sediments consist of sand and clay with high percentage of sodium chloride (Gindy and EL-Askary, 1969).

The supply of water in Siwa is artesian flowing from 200 springs. Shata et al. (1962) indicated that this water is drived from Miocene aquifers and its age dated 30000 - 50000 years (late Pleistocene). The total soluble salts in the water of spring range between 1900 and 8200 ppm reaching to 25000 ppm in Temaira and EL Maasir area with conductivity of 3000-5000 mS/cm. The salts in the water were sodium chloride, magnesium chloride, magnesium, sulphate, calcium sulphate and calcium bicarbonate. The water of springs is warm with temperature varying between 26.5°C and 30°C (Salih, 1970; PBDSO, 1988).

The climate of Siwa Oasis is highly arid. The means of 30 years (1945-1975) from the climatic Normals of Egypt (Anonymous, 1978) showed that the mean maximum temperature values ranged from 19.6°C in January to 37.7°C in July. The monthly absolute minimum ranges from 4.6°C in January to 20.8°C reaching in July and the average annual temperature is 21.4°C. The average of rainfall was 9.5mm/year. The values of relative humidity ranged between 30% (in May and June) and 56% in December. Evaporation ranges between 5.4mm/day in December and 15.8mm/day in June. The average of wind velocity increases during summer and autumn (reaching to 40.1km/h) and decreases in spring reaching 21.7km/h.

The Siwa depression embraces 18 lakes that vary in area and depth. Siwa Lake is the largest (18.9x4.8km.) and deepest (-17m). It is located in the eastern side of the oasis (Fig. 1). Seasonally, the areas of these lakes are increasing during winter where the evaporation rate is decreasing due to low temperature. The maximum total area of these lakes increased in winter to 9000 feddans, and decreased in summer to 3700 feddans. The water sources of these lakes are: 1) Springs water which are not used in the cultivation due to its high salinity and 2) The drainage water from the cultivated lands throw the drains (PBDSO, 1988). As a result of non clearing of the springs and closing the crevices of the water in these springs, the released water to the adjacent lands is causing an increase in the level of water table (A.O.A.D., 1977).

Zahran (1972) divided the wild vegetation in Siwa Oasis into four ecosystems are namely: 1) reed swamps, 2) salt marsh, 3) sand formations and

SPECIES DIVERSITY AND PHENOLOGY IN THE WETLAND VEGETATION OF SIWA OASIS, IN THE WESTERN DESERT OF EGYPT.

*Elkhouly A. Ahmed and **Khedr A. Abdel-Hamid

*Department of Plant Ecology and Range Management, Desert Research Center, Mataria, Cairo.

**Botany Department, Faculty of Science at Damietta, Mansoura University, New Damietta Box 34517, (Fax 057-403868, email: abdelkhedr@yahoo.com)

ABSTRACT

This study evaluates species diversity, phenology and the effect of environmental variables on the vegetation composition of the wetland habitats in Siwa Oasis. Thirty-six stands were sampled in the different habitats (salt marsh, lakes and springs). These stands were classified into four vegetation groups using TWINSPAN analysis. The indicator species were *Juncus rigidus, Alhagi maurorum* (Group A), *Arthrocnemum macrostachyum* (Group B) *Phragmites australis, Scirpus litoralis* (Group C), *Typha domingensis, Ceratophyllum demersum* (Group D). Soil salinity, water table and the percentage of gravel in the soil showed significant variations among vegetation groups. The diversity indices did not vary among the groups.

The distribution pattern of the dominant species along the gradient of nine environmental variables was examined using canonical correspondence analysis (CCA) ordination.

The number of species with vegetative, flowering and fruiting plants was higher in summer, while the number of species with dormant plants was higher in winter in reed swamp habitat. An opposite trend of change in the phenological status (dormant, vegetative and flowering) of plant species in dry and wet salt marsh was detected. The number of species with fruiting plants had two peaks one in summer and one in winter.

The floristic changes of Siwa Oasis wetland within the last thirty years were discussed. Also, some reasons that may led to the disappearance of some species e.g. *Cladium mariscus* which was previously reported as dominant species are given.

Keywords: salt marsh, reed swamps, springs, lakes, multivariate analysis, edaphic factors

VII. Southwest Africa

Prodromus emer Flora von Stidwestafrika covers Angola and Namibia, edited by H. Merxmuller.

monocots. The families, genera and species are described. Keys to genera and species, the geographical distribution in Somalia and the general distribution are given. Vernacular names of plants are given. Selected specimens for every species are cited. Many line drawings appear in the Flora.

III. West Tropical Africa

1. Floras covering vast territories

The first edition of Flora of West Tropical Africa by J. Hutchinson & I. M. Dalziel was published by Royal Botanic Gardens, Kew, in two volumes (1927-1936). The second edition appeared in three volumes. Volume 1 was revised by R. W. Keay and appeared in two parts, part 1(1954) and part 2 (1958). Volumes 2 and 3 were revised by F. N. Hepper, vol.2 (1963) and vol.3 in 2 pails: pail 1(1968) and pail 2 (1972). Volumes 1 & 2 cover the dicots and vol. 3 the monocots. The Flora covers the following countries: southern Mauritania, southern Mali, Senegal, Gambia, Guinea-Bissau, Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, Burkina, Togo, Benin, Nigeria, southern Niger and northern Cameroon. Detailed keys to the genera and species, citation of selected specimens, distribution in the flora area and general distribution are given. Some line drawings appear in the Flora.

2. Floras covering individual countries

Several Floras dealing with individual countries in Tropical West Africa have been published, e.g., Flore du Senegal, Flore du Gabon and Flore du Cameroun.

IV. Central Africa

Among the important Floras on Central African countries are: Flora of Tropical Africa in 10 vols. (1868-1937), Flore du Congo Beige et du Ruanda-Urundi (1948-1963); Flore du Congo, du Ruanda et du Burundi (1967-1971); Flore de l'Afrique Centrale, started 1972.

V. Tropical South Africa

The most important Flora dealing with Tropical South Africa is Flora Zambesiaca, started in 1960, in progress. It covers Zambia, Malawi, Mozambique, Zimbabwe and Botswana. Detailed descriptions to the families, genera, and species, and keys to genera and species are given. Selected specimens are cited. The distribution in the flora area and the general distribution are given. The Flora is illustrated by line drawings. The Flora appears in volumes, edited by F. Launert and G. V. Pope, of which about 60% has been published. It is planned to complete the Flora by 2005.

VI. Southern Africa

a. Plants of southern Africa: names and distribution, edited by T. H. Arnold & B. C. de Wet in 825 pages (1993), Pretoria. It covers the mosses, ferns, gymnosperms and flowering plants. This rich flora has about 24500 species, one of the richest regions in the world, or about 10% of the flora of the world.
b. Flora of Southern Africa is being published in volumes, in progress.

e. Flora of Egypt Checklist, by L. Boulos, 1995, Al Hadara Publ. Cairo. An enumeration of the accepted names of spontaneous and naturalized plants, synonyms full references to scientific names, ecological notes and distribution in Egypt.

f. Flora of Egypt, by L. Boulos, vol 1(1999), vol.2 (2000), Al Hadara Publ., Cairo. Volume 1 covers the ferns, gymnosperms and the dicot families up to Oxalidaceae. Volume 2 covers the families Geraniaceae to Boraginaceae. The families, genera and species are described and keys to genera and species are given. Accepted names, synonyms and infraspecific taxa are enumerated with their references, distribution in Egypt and general distribution. Notes on some species often discuss taxonomic problems, citation of type specimens or uses of plants. Line drawings of most of the species and colour plates are provided. Two more volumes are expected: vol.3 will complete the dicots, and vol 4 the monocots.

II. Tropical East Africa

1. Floras covering vast territories

Here one major Flora is to be mentioned: Flora of Tropical East Africa, covering Kenya, Uganda and Tanzania. It has been published in family fascicles since 1952 and is planned to be finished by 2005. Over 12,000 species represented by 247 families will be treated. This monumental Flora has been edited by several editors during the last 49 years: W. B. Turrill, E. Milne-Redhead, C. E. Hubbard, R. M. Polhill and H. J. Beentje. The Flora is published by Royal Botanic Gardens, Kew.

2. Floras covering individual countries

a. Sudan

The Flowering Plants of the Sudan in three volumes, by F. W. Andrews, vol.1(1950), vol.2 (1952), vol.3 (1956), Abroath, covers the wild and naturalized species. Keys to genera and species are given. The species are described and the distribution in Sudan is given. Some species are illustrated by line drawings. This Flora needs updating.

b. Ethiopia

A modern Flora of Ethiopia is under preparation of which 4 volumes are published (1989, in progress), Addis Ababa. Four more volumes are expected. The Flora is edited by S. Edwards, Mesfin Tadesse and I. Hedberg. The families, genera and species are described and keys to genera and species are given. Selected specimens are cited. Geographical distribution of the species in Ethiopia and the general distribution are provided. Vernacular names of plants are given. Some taxa are illustrated by line drawings.

c. Somalia

Flora of Somalia, by M. Thulin (ed.) in four volumes, of which three are published by Royal Botanic Gardens. Kew: vol. 1(1993), vol.4 (1995) and vol.2 (1999). Volumes 1 and 2 partly cover the dicot families which will be completed by vol.3. Volume 4 covers the

Algeria

Nouvelle Flore de l'Alg6rie by P. Quezel & S. Santa, vol.1(1962), vol.2 (1963). C.N.R.S., Paris. Detailed Keys to genera and species, with ecological data and distributions are given, some species are illustrated by line drawings.

Tunisia

Flore de la Tunisie, vol.1, by A. Cue'nod & G. Pottier-Alapetite (1954), Tunis. Vols. 2 (1979) & 3 (1981) by G. Pottier. Alapetite, Tunis. Volume 1 covers the ferns, gymnosperms and monocots, while vols. 2 & 3 cover the dicots. Keys to the genera and species followed by detailed descriptions of the species, distribution in Tunisia and general distribution are given. Some species are illustrated by line drawings.

Libya

a. A Preliminary checklist of Libyan Flora 2 vols., by H. G. Keith, 1965, Ministry of Agriculture, Tripoli, Libya. Scientific and vernacular names of plants and their distribution in Libya are given. Some plants are illustrated by black and white photographs.

b. Flora of Libya, Fasc. l-15O, by S. I. Ah, S. M. H. Jafri & A. A. El-Gadi (eds), 1976- 1989, Tripoli, Libya. A detailed Flora in fascicles by family. Adequate descriptions for families, genera and species and keys to separate them are given. Most of the species are illustrated with good line drawings. Local and general distribution of the species with citation of specimens and collectors are given.

Egypt

a. A manual flora of Egypt, by R. Muschler, in two volumes, 1912, Berlin. Keys to genera and species, description of species and their distribution in Egypt and general distribution are given. The flora is not illustrated.

b. Flora of Egypt, by V. Tackholm and M. Drar. Four volumes appeared, vol.1 (with G. Tackholm) in 1941, vol.2 in 1950, vol.3 in 1954 and vol.4 in 1969, Cairo University. This encyclopedic flora covers the spontaneous as well as the naturalized and cultivated plants, their history, uses and ample literature on every species. The flora is not illustrated. Unfortunately the four vols. cover only the ferns, gymnosperms, monocot families and the beginning of the dicots.

c. Students' Flora of Egypt, by V. Tackholm, 1974, Beirut, published by Cairo Univ. In this Flora keys to genera and famihes as well as short descriptions of the species, their distribution in Egypt are given. About 1/3 of the species are illustrated by line drawings and colour photos.

d. Flora of Egypt, by M. N. El-Hadidi (ed.) 1980-1998, Taeckholmia additional Series, Cairo, in fascicles of families. Species are described in detail, accompanied by line drawings and citations of selected specimens. Most of the treated families are small (1- few species), few of medium size, no major families have been published. This flora is meant to be a continuation of Tackholm & Drar, Flora of Egypt, vols. 1-4.

STATUS OF FLORISTIC STUDIES IN AFRICA

Loutfy Boulos

The biodiversity in the African continent has inspired botanists since early times to write accounts on its Flora with its most diverse habitats. The African Floras are either dealing with vast territories such as north Africa and the Sahara, tropical east Africa, tropical west Africa, tropical south Africa, southern Africa, southwest Africa or are restricted to individual countries. Some others are devoted to smaller regions. In this account we shall review the most important modern works covering major regions as well as some others dealing with individual countries.

I. North Africa and the Sahara

Floristic studies on North Africa and the Sahara may be recognized under two major categories:

1. Floras overing vast territories: Here two works are to be mentioned:

a. Flore de l'Afrique du Nord by R. Maire in 16 volumes, 1952-1987, Lechevalier, Paris. It covers Morocco, Algeria, Tunisia and Libya. Keys to the genera and species are given. For every species the synonyms, a detailed description, a line drawing, infraspecific taxa and their distribution in the flora area as well as the general distribution are given. Unfortunately the work is incomplete as it covers the ferns, gymnosperms, all the monocot. families and the dicots up to Leguminosae. It is very unlikely that this work will ever be completed.

b. Flore du Sahara Septentrional et Central, by P. Ozenda, C.N.R.S., Paris, 1958. A second edition was published in 1977. An introduction is given about the climate and vegetation, with detailed keys to separate the species and some illustrations including photos and line drawings.

c. Med-checklist, vols. 1(1984), 3 (1986), 4 (1989), by W. Greuter, H. M. Burdet & G. Long (eds), Gene've. It covers the Mediterranean region including North Africa from Egypt to Morocco. The accepted names and synonyms with their references and the distribution in relevant countries are given. The families, genera and species are arranged alphabetically. Volumes 2 & 5 are not published yet.

2. Floras covering individual countries

Morocco

a. Catalogue des plantes du Maroc: vol. 1(1931), vol.2 (1932), vol.3 (1934), Alger, by E. Jahandiez & R. Maire, vol.4 (1941) by L. Emberger & R. Maire, Alger.

b. Flore du Maroc, analytique, descriptive et illustre'e, by Ch. Sauvage & J. Vindt, vol.1 (1952), vol.2 (1954). Trav. Inst. Sci. Se'r. Bot., Rabat.

c. Flore Pratique du Maroc, vol.1, by M. Fennane *et al.* (eds), 1999. Rabat. Detailed keys to genera and species, ecological data, line drawings and distribution are given. Two more volumes are expected to cover the entire flora of Morocco.

Walker, P.H, Hall, G.F. and Protz, R. 1968. Relation between landform parameters and soil properties.Soil Sci. Soc. Am. Proc., 32: 101-104.

Williams , J.R., Renard, K.G., and Dyke, P.T. 1983. EPIC, a new method for assessing erosion's effect on soil productivity. J. Soil and Water cons . , 38: 381 – 383.

Wischmeier, W.H. , Johnson, C.B. and Dross, B.V. 1971. A soil erodibility nomograph for farm land and construction sites . J. Soil and Water Cons., 26: 189 –193.

REFERENCES

Ball, J. 1939. Contribution to the geography of Egypt . Surv. Dept. publ., Cairo , Egypt.

Black, C. A. 1965. Methods of soil analysis. Am Soc. Agron. Madison, Wisc. U.S.A.

Daniels, R.B., Gilliam, J.W. Cassel , D.K. and Nelson, L.A. 1985. Soil erosion class and landscape position in the North Carolina Piedmont, Soil Sci. Soc. Am. J. 49: 991 – 995 .

El-Hassanin, A.S.1983.Physical, chemical and mineralogical characteristics of soil vs. creodibility. Ph. D Thesis, Oklahoma State Univ., Oklahoma, U.S.A.

Folk, R.L. and word , W.C. 1957. Brazos River bar, A study in the significance of grain size parameters . J. Sed. Petrol. Vol. 27: 3-26.

Frye, W.W, Ebelhar, S.A., Murdock, L.W. and Blevins, R.L. (1982). Soil erosion effects on properties and productivity of two Kentucky Soils. Soil Sci. Soc. Am. J. 46:1051 – 1055.

Gaber, E.I 1989. Dynamics of soil erosion as related to soil forming factors in Burundi . Ph.D Thesis, Inst. of African Res. and studies , Cairo Univ, Egypt.

Gamble, E.E. and Daincls, R.B. . 1974. Parent material of the upper and middle coastal plain soils in northern Carolina. Soil Sci. Soc. Am. Proc., 38: 633

Geicer, L. and Nettleton, W.D. 1979. Properties and geomorphic relationship of some soils of Liberia . Soil Sci. Soc. Am. J., 43: 1192–1198.

Hassett .J.J. and Banwart, W.L. 1992. Soils and their environment Prentice Hall, Englewood Cliffs, New Jersey . U.S.A, 424 p.

Jackson, M.L. 1969. Soil chemical analysis advanced course. Published by the auther, Wisconsin Univ., Madison, U.S.A.

Lewis, D.T, and witte, D.A. 1980 Properties and classification of an eroded soil in southeastern Nebrasica. Soil Sci. Soc. Am. J. 44: 583

Pregitzer, K.S. Barnes , B.V. and Lemme, G.D. 1983. Relationship of tography to soils and vegetation in an upper Michigan ecosystem. Soil Sci. Soc. Am. J., 47: 117- 123.

Schumm, S.A and Hervey, M.D 1982. Natural erosion in the USA. In : Determinants of Soil Loss Tolerance. ASA and SSSA spec. pub. No. 45. Madison, Wisconsin , U.S.A. 153 p.

Shah, R.K. and Patel, N.A. 1973. Influence of seasonal temperature changes an permeability of soil in relation to salt solution. Indian . J. Agric. Res., 7 (3): 165 – 168.

Stakman, W.P. and Vander Hast , G.G.1966. The use of the pressure membrane apparatus to determine soil moisture contents at P^F 3 to 4.2 inclusive. Institute for Land and Water Management Research. Note No. 159

Stone, J.R. , Gilliam, J.W., Cassel , D.K., Daniels, R.B., Nelson, L.A and kleiss, H.J. 1985. Effect of erosion and landscape position on the productivity of Piedmont soils. Soil Sci. Soc. Am.J., 49: 987 – 991.

USDA. 1981. Soil erosion effects on soil productivity: a research perspective. J. Soil and Water Cons., 36: 82 – 90 .

Table (5): Soil erodibility factor (K) as related to soil properties based on wischmier's Nomograph.

Slope position	Soil depth	% sand (0.1-2mm)	V.F.Sand+ M.Sand	O.M. %	Structure	Permeabilty	K
				Wadi Sermatla			
Upper	0-10	61.8	36.6	0.15	fine gr.	slow	0.5
	10-20	65.3	32.1	0.16	medium gr	slow	0.51
	20-40	58.4	38.0	0.13	massive	slow	0.48
	40-60	59.9	37.1	0.12	massive	slow	0.47
Middle	0-10	53.1	43.0	0.22	medium gr	slow	0.49
	10-20	50.7	43.0	0.20	medium gr	slow	0.49
	20-40	45.6	46.0	0.16	blocky	slow	0.48
	40-60	45.4	45.8	0.13	massive	slow	0.46
Lower	0-10	39.6	47.9	0.24	fine gr.	slow to mod.	0.40
	10-20	35.8	49.3	0.22	massive	slow to mod.	0.47
	20-40	31.8	49.8	0.17	massive	slow to mod.	0.47
	40-60	30.8	47.6	0.14	blocky	slow to mod.	0.48
				Wadi Odaib			
Upper	0-10	61.3	37.2	0.13	coarse gr.	slow	0.54
	10-20	60.0	37.4	0.12	coarse gr.	slow	0.50
	20-40	60.2	36.5	0.13	massive	slow	0.46
	40-60	59.2	37.5	0.10	massive	slow	0.46
Middle	0-10	51.3	54.4	0.20	medium gr	slow	0.48
	10-20	51.2	42.6	0.11	massive	slow	0.46
	20-40	46.5	45.3	0.13	massive	slow	0.44
	40-60	43.7	47.8	0.13	massive	slow	0.44
Lower	0-10	35.5	49.1	0.22	fine gr.	slow to mod.	0.44
	10-20	37.3	46.6	0.18	massive	slow to mod.	0.46
	20-40	36.1	48.1	0.15	massive	slow to mod.	0.48
	40-60	38.5	45.2	0.07	massive	slow to mod.	0.46
				Wadi Doaet			
Upper	0-10	58.0	40.6	0.14	coarse gr.	slow	0.56
	10-20	55.3	40.3	0.10	coarse gr.	slow	0.52
	20-40	56.5	39.1	0.07	massive	slow	0.49
	40-60	58.1	35.7	0.11	massive	slow	0.49
Middle	0-10	46.1	43.3	0.19	medium gr	slow	0.48
	10-20	40.5	48.2	0.16	medium gr	slow	0.48
	20-40	40.8	48.8	0.12	massive	slow	0.44
	40-60	44.3	45.1	0.12	massive	slow to mod.	0.44
Lower	0-10	32.2	55.3	0.25	fine gr.	slow to mod.	0.43
	10-20	38.1	49	0.24	medium gr	slow to mod.	0.40
	20-40	35.3	50.3	0.18	massive	slow to mod.	0.35
	40-60	30.2	45.3	0.20	massive	slow to mod.	0.39
				Wadi Craff			
Upper	0-10	61.0	38.0	0.13	coarse gr.	slow	0.48
	10-20	55.7	37.0	0.12	coarse gr.	slow	0.46
	20-40	54.2	37.0	0.11	medium gr	slow	0.45
	40-60	52.1	44.0	0.10	massive	slow	0.47
Middle	0-10	48.6	46.4	0.18	corse gr.	slow	0.48
	10-20	44.2	52.7	0.13	medium gr	slow	0.38
	20-40	47.1	46.8	0.11	medium gr	slow	0.40
	40-60	40.1	52.7	0.11	fine gr.	slow	0.46
Lower	0-10	32.4	57.9	0.23	fine gr.	slow to mod.	0.42
	10-20	35.0	55.0	0.24	fine gr.	slow to mod.	0.40
	20-40	32.6	49.5	0.18	massive	slow to mod.	0.35
	40-60	34.5	55.9	0.18	massive	slow to mod.	0.37

Soil erodibility vs. soil properties:

Soil erodibility describes the inherent susceptibility of a given soil to water erosion. It is a complex property that depends on the infiltration capacity of the soil and on its capacity to resist detachment and transport by rainfall and runoff. Field measurements of soil erodibility are costly and time-consuming, so it is common to estimate erodibility from more easily measured soil properties that are strongly correlated with erodibility such as soil texture, aggregates stability or structure , infiltration capacity and organic matter. We used USDA erodibility nomograph (Wischmeier, et al., 1971) in estimating erodibility index (K). **Table (5)** shows erodibility index as related to soil properties at different slope positions of the studies wadis. Data revealed that soil erodibility factor (K) decreased down slope and with soil depth. This trend was obtained for all the studied wadis. K values ranged between 0.35 and 0.56. The variations in soil properties up –down slope lead to variation in K values and reflect the sensitivity of soils to erosion.

CONCLUSION

[illegible] With the accelerated rate of soil erosion. So, it is far more prudent to reduce soil erosion to tolerable levels than to attempt to replace topsoil.

The energy associated with splash and surface flow erosion aggressively and selectively erodes soil constituents downslope. This basic skeleton of movement delineates the expected changes in soil properties with slope length. ER values for fine soil particles, organic matter, and soluble cations and anions were always higher than one indicating the great losses of these constituents downslope with runoff.

The variability in surface soil properties up-down stream within the studied wadis is not necessarily random but is related to the range of intensities of the erosional processes that have been operating within the landscape positions. Loss of plant available soil water capacity, loss of plant nutrients, degradation of soil structure, and nonuniform removal of soil within a field are ways in which erosion decreases soil productivity.

Table (4)Effect of erosion and slope positons on soil chemical properties

Slope position	Soil depth	EC (ds/m)	pH	Soluble cations and anions (meq/L)							
				Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$CO^{=}_{3}$	HCO^{-}_{3}	Cl^{-}	$SO^{=}_{4}$
		Wadi Sermatia									
Upper	0-10	1.01	7.68	3.25	1.83	4.27	0.61	0.0	3.3	6.35	0.4
	10-20	0.68	7.7	1.9	1.05	3.14	0.37	0.0	3.5	3.05	0.3
	20-40	0.68	7.7	2.2	1.18	3.3	0.41	0.0	3.25	3.3	0.3
	40-60	0.63	7.7	2.1	1.05	2.69	0.30	0.0	3.2	3.0	0.1
Middle	0-10	1.27	8.14	4.22	1.70	5.45	1.17	0.0	3.8	8.5	0.4
	10-20	1.28	8.21	4.6	2.99	4.3	0.57	0.0	3.25	8.0	1.5
	20-40	1.96	8.27	7.35	4.63	6.56	1.12	0.0	3.65	14.0	1.7
	40-60	2.12	8.32	6.83	5.02	8.15	1.19	0.0	4.15	17.0	2.05
Lower	0-10	4.87	8.5	7.9	4.47	32.5	2.87	0.0	6.2	38.4	4.2
	10-20	3.50	8.6	9.4	8.0	15.5	2.1	0.0	5.3	26.4	3.2
	20-40	2.40	8.45	8.5	7.2	6.1	2.2	0.0	5.4	16.3	2.3
	40-60	2.70	8.73	8.9	7.1	8.7	2.3	0.0	5.6	19.5	1.9
		Wadi Odaib									
Upper	0-10	1.47	8.0	2.8	1.58	8.2	2.11	0.0	2.75	11.12	0.84
	10-20	0.99	8.0	2.15	0.99	6.53	1.32	0.0	2.40	6.53	0.97
	20-40	0.73	7.73	1.65	0.88	4.32	0.42	0.0	2.0	4.03	1.27
	40-60	0.72	7.7	1.92	0.7	4.1	0.47	0.0	2.50	3.25	1.43
Middle	0-10	1.95	8.15	4.35	2.96	11.13	1.05	0.0	3.9	12.6	3.55
	10-20	1.78	8.15	2.75	1.3	12.12	1.7	0.0	4.4	10.95	2.5
	20-40	1.57	8.12	1.40	0.6	11.55	2.19	0.0	3.8	10.05	2.4
	40-60	1.65	8.16	1.40	0.8	12.05	2.25	0.0	3.7	11.5	1.3
Lower	0-10	10.15	8.60	48.2	17.0	32.5	3.8	0.0	7.1	88.6	3.8
	10-20	13.29	8.70	58.3	32.1	38.6	3.9	0.0	7.3	121.2	4.4
	20-40	14.49	8.70	50.6	31.8	58.7	3.8	0.0	8.1	128.1	8.3
	40-60	10.66	8.71	44.1	23.88	34.9	3.72	0.0	8.5	89.9	8.2
		Wadi Doaet									
Upper	0-10	1.25	8.15	5.08	2.1	4.7	0.57	0.0	2.25	9.2	1.1
	10-20	0.94	8.15	2.9	1.1	5.05	0.38	0.0	2.0	6.5	1.05
	20-40	0.78	8.15	2.2	1.11	4.2	0.34	0.0	2.05	5.25	0.65
	40-60	0.83	8.05	1.6	0.45	5.85	0.40	0.0	2.2	5.5	0.60
Middle	0-10	2.94	8.25	9.2	4.2	15.2	0.85	0.0	4.65	20.9	3.85
	10-20	2.19	8.22	6.65	3.81	10.8	0.63	0.0	3.65	16.3	2.0
	20-40	2.23	8.15	6.92	3.75	11.3	0.37	0.0	4.0	15.35	3.0
	40-60	2.19	8.19	6.6	3.62	11.2	0.48	0.0	3.65	15.55	2.75
Lower	0-10	6.33	8.70	20.7	11.0	30.3	1.3	0.0	8.8	48.3	6.2
	10-20	8.60	8.81	28.5	9.65	46.5	1.35	0.0	9.9	68.9	7.2
	20-40	8.40	8.85	28.9	8.8	45.1	1.2	0.0	9.5	69.1	5.4
	40-60	9.50	8.50	30.1	11.3	50.4	1.2	0.0	9.9	78.3	6.8
		Wadi Craff									
Upper	0-10	0.69	7.77	2.45	1.17	3.0	0.33	0.0	3.45	2.8	0.65
	10-20	0.72	7.9	2.45	1.45	3.04	0.35	0.0	3.8	2.9	0.55
	20-40	0.66	8.25	2.6	1.38	2.35	0.26	0.0	3.1	3.05	0.5
	40-60	0.91	8.45	3.3	1.0	4.3	0.49	0.0	2.95	5.75	0.5
Middle	0-10	1.28	8.25	4.42	1.71	5.55	0.81	0.0	3.5	8.1	0.90
	10-20	1.70	8.41	3.24	1.60	9.4	2.65	0.0	5.2	11.2	0.6
	20-40	1.96	8.44	7.15	3.3	42.6	1.92	0.0	4.5	13.65	1.45
	40-60	1.90	8.28	6.2	4.1	6.91	1.65	0.0	4.5	13.3	1.2
Lower	0-10	6.40	8.6	14.4	7.6	37.52	3.98	0.0	5.8	56.1	2.1
	10-20	6.50	8.6	15.6	8.1	37.6	3.9	0.0	5.4	57.3	2.3
	20-40	5.30	8.87	10.3	3.61	36.59	2.5	0.0	5.9	43.9	3.2
	40-60	5.90	8.85	13.1	4.90	38.9	3.7	0.0	5.8	79.7	3.5

Table (3): Soil moisture retention, soil densities, hydraulic conductivity and infiltration as affected by erosion and slope positions in Halaib Wadis

Slope position	Soil depth	Volumetric moisture content retained at						Soil densities		Total porosity	H.C. (cm/hr)	Basic intake rate
		0.1	0.33	0.66	1	5	15 atm	real	bulk	%		(cm/hr)
						Wadi Sermatia						
Upper	0-10	14.2	12.4	10.9	9.2	6.9	4.0	2.65	1.83	31.2	13.4	22.5
	10-20	15.1	13.3	11.3	9.6	7.2	4.4	2.65	1.82	31.2	13.8	
	20-40	15.5	14.0	12.0	10.4	7.6	5.0	2.64	1.78	32.5	13.4	
	40-60	16.2	14.1	12.0	10.0	7.5	4.6	2.63	1.79	32.2	13.3	
Middle	0-10	15.4	13.6	11.1	9.3	7.0	3.9	2.63	1.75	33.3	7.1	17.7
	10-20	16.8	14.9	13.2	14.2	8.8	6.0	2.64	1.73	33.8	6.5	
	20-40	18.9	17.0	15.0	13.3	10.4	7.5	2.63	1.74	33.6	6.2	
	40-60	20.1	18.0	15.5	14.2	11.9	8.3	2.61	1.73	33.8	6.2	
Lower	0-10	22.5	21.0	19.8	16.9	13.8	9.1	2.60	1.72	33.8	3.2	13.2
	10-20	21.1	19.5	17.5	15.4	13.3	8.9	2.60	1.70	34.6	3.1	
	20-40	26.6	23.9	21.4	19.5	15.5	9.9	2.60	1.68	35.3	2.8	
	40-60	26.3	23.7	21.3	19.5	15.7	9.9	2.61	1.68	35.6	2.8	
						Wadi Odaib						
Upper	0-10	14.5	13.2	11.5	8.8	6.7	4.6	2.66	1.84	30.8	13.0	24.0
	10-20	15.1	13.6	11.7	9.4	7.0	5.0	2.66	1.83	31.2	11.2	
	20-40	15.3	13.8	11.9	9.6	7.3	5.2	2.69	1.85	30.8	11.2	
	40-60	15.5	13.8	12.1	9.7	7.4	5.1	2.70	1.85	30.7	11.3	
Middle	0-10	15.6	14.2	12.3	10.4	7.6	5.3	2.64	1.77	32.8	10.4	19.8
	10-20	18.9	16.6	14.8	12.7	9.4	6.7	2.64	1.78	33.1	8.2	
	20-40	16.6	18.8	16.8	14.1	11.8	7.9	2.67	1.79	33.1	7.8	
	40-60	16.5	19.1	16.8	14.6	11.8	8.0	2.67	1.78	33.5	8.0	
Lower	0-10	18.7	16.6	14.5	12.4	9.9	7.5	2.60	1.70	34.6	6.5	16.8
	10-20	24.9	23.0	21.6	19.2	14.5	9.6	2.59	1.68	35.1	5.2	
	20-40	25.7	23.5	21.9	19.5	14.8	9.9	2.59	1.68	35.1	4.9	
	40-60	25.8	24.6	22.5	19.9	15.1	9.9	2.59	1.65	35.9	4.9	
						Wadi Doaet						
Upper	0-10	16.5	14.7	12.3	10.2	7.6	5.4	2.63	1.78	31.8	11.0	25.2
	10-20	18.2	15.9	13.8	11.6	9.2	6.7	2.62	1.78	31.8	10.9	
	20-40	16.7	14.8	12.5	9.8	7.8	5.7	2.62	1.76	32.4	10.2	
	40-60	17.6	15.6	13.0	11.0	8.7	6.5	2.62	1.75	33.1	9.4	
Middle	0-10	22.0	19.5	17.1	14.1	11.8	8.0	2.60	1.73	33.3	5.1	20.4
	10-20	23.4	20.6	18.3	16.5	13.3	8.8	2.60	1.71	33.8	4.5	
	20-40	22.5	20.1	18.0	13.9	11.4	7.8	2.85	1.68	33.7	4.3	
	40-60	22.7	20.4	18.2	14.2	11.6	8.8	2.85	1.68	34.1	4.6	
Lower	0-10	19.3	17.0	14.4	14.0	13.0	8.9	2.60	1.70	34.3	4.8	16.8
	10-20	24.8	22.1	19.9	17.6	14.7	9.1	2.56	1.65	35.2	3.8	
	20-40	24.8	22.3	20.1	17.8	14.9	9.5	2.56	1.64	35.6	3.8	
	40-60	25.2	22.9	20.3	18.1	15.6	9.5	2.55	1.63	35.7	3.9	
						Wadi Craff						
Upper	0-10	14.3	12.4	10.2	8.1	6.2	4.4	2.64	1.82	30.6	12.0	26.7
	10-20	15.3	13.0	10.7	8.5	6.5	4.8	2.62	1.82	30.4	11.5	
	20-40	16.0	13.8	11.8	9.5	7.6	5.4	2.62	1.78	31.5	11.2	
	40-60	16.0	14.0	11.7	9.5	7.6	5.5	2.62	1.75	32.7	11.5	
Middle	0-10	16.2	13.7	11.7	9.7	7.8	5.6	2.61	1.78	31.5	8.0	22.5
	10-20	17.5	15.2	13.2	11.3	9.1	6.4	2.63	1.76	32.7	7.0	
	20-40	18.5	16.5	14.2	12.1	9.8	6.8	2.64	1.75	33.5	6.7	
	40-60	19.0	16.8	14.7	12.6	10.7	7.3	2.63	1.74	33.5	6.7	
Lower	0-10	19.3	16.9	14.8	12.6	10.3	7.6	2.62	1.74	33.3	4.3	18.6
	10-20	20.1	18.2	16.0	13.8	11.5	7.9	2.58	1.70	33.9	3.7	
	20-40	20.9	18.5	16.3	14.1	11.9	7.1	2.56	1.67	34.7	3.9	
	40-60	23.5	20.4	17.9	15.6	13.3	9.8	2.65	1.67	34.5	3.7	

matter contents down slope. This was supported by significant correlation coefficient between the percent clay in the surface layer of the soil and its available water holding capacity. Available water capacity of the 10- to 20 cm depth was not significantly

Different between upper and lower slope positions. This trend was obtained with all the studied wadis. The change in soil water regime of the surface layer is mainly rendered to water erosion process and enhanced by the influence of landslope factor. Pore size distribution exhibited the same trend as moisture retention at different slope positions . Fine capillary pores and water holding pores increased down slope.

Values of hydraulic conductivity ranged between 2.8 and 13.8 cm/hr. The low values were obtained in the lower slope positions owing to the increase of fine soil particles transported by water erosion process. Basic infiltration rate values showed the same trend as hydraulic conductivity . They ranged between 13.2 and 26.7 cm / hr where they decrease with increasing slope length. Infiltration rate is of great importance since it often determines the amount of runoff, erosion and water retention in the rooting zone. Erosion also influences infiltration through the impact of raindrops which seal the surface and reduce infiltration rate.

Impact of erosion and landslope positions on soil chemical properties is shown in **Table (4)**. EC values fluctuated between 0.6 and 14.5 ds/m . The lowest values were obtained in the upper slope positions. The highest values were found down slope near the Red Sea Coast. Soil salinity tends to concentrate on the surface soil layer due to high temperature and evaporation process responsible for the deposition of salts on the surface. Soluble cations and anions were increased down slope with increasing slope length toward the sea. Na^+ was the dominant cation followed by Ca^{++} and Mg^{++}. Cl^- was the dominant anion. ER values for cations ranged between 3.13 and 4.61 and for anions ranged between 1.75 and 5.19 indicating their loss in sediments downstream. Na^+ and Cl^- exhibited the highest ER values.

Statistical grain size parameters for the studied soil profiles revealed that the soils of wadi Sarmatia are characterized by poorly sorted, near symmetric to very negative skewed and platy to lepto kurtic distribution patterns. This indicates that water is the main factor affecting transportation and deposition of the soil material. The surface layers of middle slope positions exhibited a combined action of both water and wind in their formations. The solis of wadi Odaib are mostly poor to moderate sorted, negative skewed and near symmetric, meso to lepto kurtic distribution pattern. This also reflects water action in the transportation and deposition of these sediments. Sorting values for the top layers of middle slope position indicate a combined action of both water and wind. Soils of wadi Doaet and wadi Craff exhibited similar trends as Sermatai and Odaib. Their soils are characterized by poorly to moderately sorted, negative skewed and near symmetric, and very platy to meso kurtic indicating dominant water action in their transportation and deposition.

The changes in gravel content of the studied wadis as influenced by water erosion and slope positions are presented in **Table (2).** Generally, gravel percentage tended to decrease downslope. This is due to the selectivity process during erosion where fine particles are carried away, while gravels rest upper slope.

The change in soil bulk density was influenced by the variation in soil texture, structure and soluble salts. Data in **Table (3)** show that soil bulk density decreased gradually with slope length. This is mainly rendered to erosion process and transport of fine particles down slope. Statistically, significant positive correlation was found between coarse sand and soil bulk density. On the other hand, significant negative correlation was obtained between soil bulk density and both of slit and clay fractions. .Soil porosity increased down slope due to the increase of fine soil particles and organic matter

The soil water regime is often cited as being affected by soil erosion and land slope positions. Lower slope positions have been found to contain more available water than those of higher positions on the same slope.

These differences in available water were probably due to differences in runoff among landscape positions and to the effects of internal drainage from the upper to the lower positions. Data of soil moisture retention for the profiles representing different wadis are presented in **Table (3)**. There are differences in the shape and magnitude of the moisture retention curves between soil profiles representing landslope positions. These differences were small between different wadis. The upper slope positions, which contain high amount of coarse sand and macro pores, showed a decrease in the moisture content particularly at low suctions. Lower slope positions retain more moisture content due to the increase of fine particles and water holding pores. Available water holding capacity for the surface layer was 2-4 % higher in the lower slope positions (depositional uneroded soils) compared to the eroded upper slope positions. This is probably related to both the high clay and organic

Table (2): Particle size distribution, organic matter content, and grain size statistical parameters as affected by erosion and land slope positions in Halaib wadis.

Slope position	Soil depth	Particle size distribution (%)				O.M. (%)	Grain size parameters				Texture class	Gravels (%)
		C. Sand	F. Sand	Silt	Clay		M_z	Q'	SK	K_G		
		Wadi Sermatla										
Upper	0-10	50.5	39.8	8.0	1.6	0.15'	2.10	1.21	-0.35	0 80	Sandy	46.5
	10-20	55.4	35.6	6.8	2.0	0.16	1.90	1.15	-0.14	0 83	Sandy	47.5
	20-40	50.8	36.5	9.4	3.2	0.13	1.80	1.05	0.0	1 06	S.Loam	40.0
	40-60	50.1	35.8	10.6	3.3	0.12	1.90	1.06	-0.14	0 95	S.Loam	37.5
Middle	0-10	35.3	47.9	14.6	2.1	0.22	2.60	1.09	-0.49	1 01	S.Loam	20.0
	10-20	41.8	38.3	15.9	3.9	0.20	2.23	1.16	-0.37	0 89	S.Loam	15.0
	20-40	33.6	42.0	17.7	6.7	0.16	1.90	1.16	-0.37	0 89	S.Loam	15.0
	40-60	38.6	40.8	13.6	6.9	0.13	1.43	0.88	0.06	1 02	S.Loam	10.0
Lower	0-10	26.3	45.8	19.8	8.0	0.24	1.90	1.10	-0 15	0 07	L.Sand	4.0
	10-20	32.1	41.2	17.2	9.3	0.22	1.71	1.10	-0.07	0.81	L Sand	6.0
	20-40	31.1	36.8	19.7	12.3	0.17	1.56	1.17	-0.07	0.67	L.Sand	4.0
	40-60	29.7	37.5	19.4	13.2	0.12	1.85	1.15	-0.17	0.80	L.Sand	4.0
		Wadi Odaib										
Upper	0-10	49.2	41.3	7.8	1.6	0.13	2.45	1.01	-0.41	0.90	Sandy	36.5
	10-20	48.0	41.1	8.1	2.7	0.12	2.10	1.13	0.30	0.85	S.Loam	32.5
	20-40	48.1	38.8	9.7	3.3	0.13	1.75	1.13	0 27	0.82	S.Loam	40.0
	40-60	46.6	39.0	11.0	3.3	0.10	1.75	1.10	0.19	0.87	Sandy	39.0
Middle	0-10	41.1	49.2	6.5	3.2	0.20	2.26	0.76	0.06	0.82	S.Loam	28.0
	10-20	41.5	48.9	6.5	3.2	0.11	2.23	1.08	0.18	0.96	S.Loam	19.0
	20-40	38.1	39.0	15.3	7.5	0.13	2.06	1.29	0.24	0.76	S.Loam	21.0
	40-60	35.8	37.9	17.8	8.5	0.13	1.90	1.13	0.21	0.96	S.Loam	10.0
Lower	0-10	27.3	39.0	18.1	15.5	0.22	2.10	1.06	0.30	0.83	L.Sand	14.0
	10-20	27.0	37.2	19.5	15.7	0.18	1.75	1.22	0.20	0.72	L.Sand	16.0
	20-40	27.1	35.9	21.0	15.9	0.15	1.56	1.23	0.10	0.97	L.Sand	20.0
	40-60	30.6	32.5	20.0	16.3	0.07	1.45	1.17	0.04	0.79	L.Sand	18.0
		Wadi Doaet										
Upper	0-10	48.0	41.8	6.7	3.4	0.14	1.90	1.03	0.25	0.90	S.Loam	20.0
	10-20	46.7	41.0	7.9	4.4	0.10	1.80	1.03	0.19	0.92	S Loam	18.5
	20-40	46.6	40.8	8.1	4.4	0.07	1.75	1.06	0.16	C.95	S.Loam	13.5
	40-60	47.6	37.1	8.5	6.6	0.11	1.50	1.00	0.24	C 95	S.Loam	12.5
Middle	0-10	30.7	45.2	14.1	10.1	0.19	2.3	1.21	0.62	C 95	S.Loam	10.0
	10-20	29.7	48.1	10.9	11.3	0.16	1.20	1.21	0.62	C.87	S.Loam	3.5
	20-40	38.2	40.5	10.8	10.4	0.12	1.20	1.18	0.38	C.87	S.Loam	3.5
	40-60	30.7	46.3	12.4	10.6	0.12	1.00	1.18	0.27	C.74	S.Loam	5
Lower	0-10	22.3	43.1	22.4	12.2	0.25	1.90	1.15	0.28	C.70	L.Sand	6.5
	10-20	23.5	40.3	17.5	13.5	0.24	1.55	1.34	0.16	0.82	L.Sand	7.0
	20-40	25.6	38.1	22.1	14.2	0.18	1.90	1.34	0.22	0.96	L.Sand	6.5
	40-60	30.8	35.9	18.1	15.2	0.20	1.90	1.44	0.32	0.69	L.Sand	5.0
		Wadi Craff										
Upper	0-10	51.6	41.0	5.9	1.40	0.13	1.80	1.09	0.28	0.90	Sandy	14.0
	10-20	47.2	44.1	6.5	2.2	0.12	1.76	1.07	0.08	0.93	Sandy	19.0
	20-40	43.9	46.2	6.4	3.3	0.11	1.73	1.05	0.20	0.98	Sandy	12.0
	40-60	44.3	45.5	6.2	3.8	0.10	1.90	1.06	0.22	0.90	S.Loam	16.0
Middle	0-10	35.8	45.7	13.5	4.9	0.18	2.40	1 18	0.51	0.97	S.Loam	8.0
	10-20	36.6	47.1	13.2	3.1	0.13	2.03	1.26	0.22	0.78	S.Loam	10.0
	20-40	43.6	39.9	10.4	6.1	0.11	1.53	1.23	0.12	0.82	S.Loam	19.0
	40-60	39.3	39.1	14.4	7.1	0.11	1.70	1.16	0.13	0.89	S.Loam	18.0
Lower	0-10	24.3	45.3	20.6	9.7	0.23	2.25	1.18	0 34	0.92	L.Sand	5.0
	10-20	29.0	40.7	20.4	10.0	0.24	1.90	1.28	0 16	0.80	L.Sand	3.0
	20-40	31.4	39.6	18.7	10.1	0.18	1.56	1.11	0.12	0 91	L.Sand	2.0
	40-60	35.2	41.9	13.2	9.5	0.18	1.68	1.09	0.08	0.86	L.Sand	3.0

removal of silt and clay down slope has great significance in studies of water pollution due to the high carrying capacity of these fine eroded materials.

The results also indicated that the clay content increased with depth and was highest at 40 – 60 cm. The higher clay content of the subsurface soil may have been caused by illuviation. The increase of clay and slit in the subsurface layer of down slope position indicates that subsurface water erosion, beside illuviation , may have been taking place.

The changes in soil organic matter content with slope position and soil depth as affected by water erosion are presented in **Table (2).** Generally, organic matter content ranged between 0.08 and 0.3 %. It is exposed to transport process down slope. ER values of organic matter for the surface soil layers were 1.62, 1.62, 2.3 and 2 for Sermatia, Obaib, Doeat and Deep Craff wadis, respectively. Fertile soils were found down slope due the accumulation of transported organic matter and fine soil materials. The removal of these materials is the main feature of erosion process especially when vegetation cover is absent. This has a great influence on soil properties and erodibility.

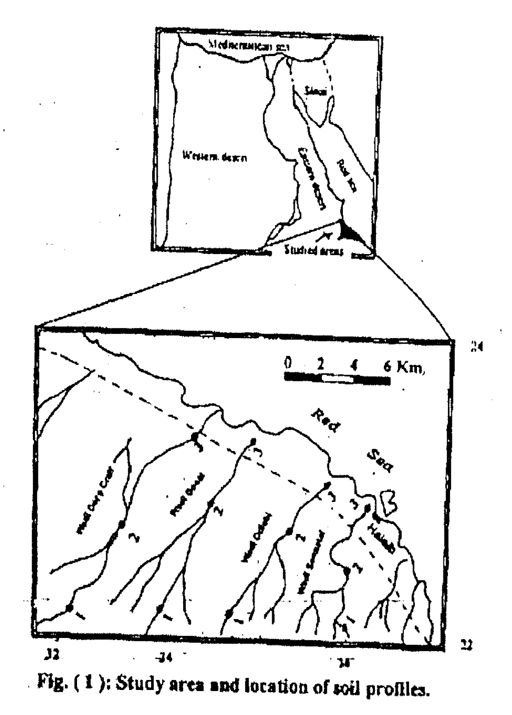


Fig. (1): Study area and location of soil profiles.

RESULTS AND DISCUSSIONS

Effect of water erosion and landslope positions on soil properties:

Erosion results in changes in soil properties which are believed to decrease soil productivity. Losses of clay and organic matter from the surface soil layer are frequent as erosion severity increased. The removal of fine soil particles via water erosion tends to be selective where they are more vulnerable to erosion than coarse soil fractions. **Table (2)** shows the effect of water erosion and slope positions on physical soil properties in some Halaib's wadis, i.e, Sermatia , Odiab, Doaet ,and Deep Craff. Results of particle size distribution revealed that silt and clay particles were gradually increased down slope. They increased in the surface layer (0-10 cm) from 9% in the upper slope position to 31.5 % in the lower slope position with an Enrichment Ratio (ER) of 3.47, the ratio of soil material in the eroded sediment to that in soil matrix. Clay fraction increased down slope with ER of 5.67. ER value for silt fraction was 2.85. These results indicate that both silt and clay are exposed to transportation down slope by water erosion. An opposite trend was obtained with sand fraction. ER values were less than one indicating little movement of sand particles. This sorting of particle size distribution along slope length makes water erosion to be selective process, particularly in the surface layer. In this respect, water erosion tended to changes the surface soil texture toward the more coarse sized particles. All the studied wadis exhibited the same trend for particle size distribution with up-down stream positions. The continuous

Table (1). The soils were classified as Typic Torripsamments and Typic Torrifluvents with a texture ranges between sandy and loamy sand. $CaCO_3$ ranges between 1 and 6%. Olba mountain and its associated valleys and Red Sea mountains chains are the main topographic features in the area. These mountains are severely sloped and drain rainwater into the sea. The valleys vary in their lengths and slopes. They are surrounded by a group of ridges and knolls. The coastal plain in the area varies in width from 5 to 10 km. Wadis floors are mostly composed of alluvial materials which are derived from the denudation of the igneous and sedimentary plateau during the early and middle Paleolithic epochs (Ball, 1939). Also, these conditions encourage the formation of reddish brown soils along the main courses of these wadis.

Twelve soil profiles were dug in the main channel stream bed along the main four wadis of Halaib, i.e, Sermatai, Odieb, Doaet and Deep Craff. Each wadi was represented by three soil profiles positioned 5 km apart along a transect up- down stream to study the effect of water erosion and landslope positions on soil characteristics. Elevation difference between upper and lower slope positions ranged between 300 and 400 m with an average slope percent of about 3 %. Figure (1) shows the study area and locations of soil profiles. Soil samples were collected from each soil profile at depths of 0-10, 10-20, 20-40, and 40 –60 cm and analyzed for particle size distribution (Jackson, 1969) and grain size statistical parameters(Folk and ward, 1957), soil moisture retention (Stakman and Vander Hast, 1966), hydraulic conductivity (Shah and Patel, 1973), infiltration rate using double ring infiltrometer, and organic matter content (Black, 1965). Soil PH, total soluble salts, soluble cations and anions and Ca Co_3 % were determined according to Black (1965). Soil erodibility was determined using Wischmeier's nomograph (1971).

Table (1): Meteorological data of Halaib area (1987 – 1996) :

Month	**Temperature °C**			**Rainfall (mm)**	**Evaporation mm /day**	**Relative Humidity %**	***Wind speed* m/ sec**	**Wind Direction**
	Max	Min	Mean					
January	23	15	19	24.5	2.5	52	3.3	NW
February	24	14	16	12.4	3.3	48	3.0	NW
March	27	16	21.5	10.4	4.4	48	3.4	NW
April	33	21	27	11.4	6.5	45	3.0	NW
May	36	26	31	0.0	9.6	45	2.7	NW
June	38	29	33.5	1.2	15.5	48	2.9	NW-SW
July	38	29	33.5	0.0	12.4	48	2.9	SW
August	34	25	29.5	0.0	8.7	54	3.0	NW- SW
September	30	22	26	0.0	7.6	54	2.5	SW
October	27	16	21.5	24	5.6	65	3.0	NE
November	26	16	20	41.2	3.9	52	3.3	NE
December	25	14	19	26.1	3.5	52	3.3	NE
Mean	30	20	24.8			50	3.0	

Source : Haliab meteorological Station

the drainage system, so the effects of erosion depend largely on the original thickness and quality of the topsoil and on the nature of the subsoil. Erosion becomes more serious on soils having restrictive layers. Williams et al.(1983) used the mathematical model EPIC (Erosion – Productivity Impact Calculator) to determine the relationship between soil erosion and soil productivity.

One of the serious effects of erosion process is that the slow formation or the regeneration of the topsoil never keeps pace with the accelerated rate of erosion, especially on the upper reaches of slopes. Schumm and Harvey (1982) estimated that soils form naturally at rates of 0.5 to 0.02 mm a year. Average man – induced erosion is 2 mm per year, which is far greater than natural rates of soil formation. Therefore, soils are being depleted. Hassett and Banwart (1992) estimated that 1 cm of topsoil forms in 40 to 80 years or longer. So, it is far more prudent to reduce soil erosion to tolerable levels than to attempt to replace topsoil.

Soils are being depleted and progressively undergo less favorable properties with erosion. Gamble and Daniels (1974) observed that with erosion, the restrictive layers below the soil surface such as clay pan, fragipan, calcic and petrocalcic horizons are often brought close to the surface. Erosion has modified soil features and classification through changes in soil properties (Geicer and Nettleton, 1979; Lewis and witte, 1980; and Pregitzer et al., 1983). Fine soil particles with attached organic matter and nutrient elements are more vulnerable to erosion. They are also strongly related to topographic positions (El – Hassanin , 1983 and Gaber, 1989). Another detrimental effect of erosion is a decrease in topsoil depth and the increase of clay content in the Ap horizon (Walker *et al.*, 1968 ; Frye et al., 1982; Daniels et al., 1985; and Stone et al., 1985). The variability in surface soil properties is related to the range of intensities of the erosional processes that have been operating within the landscape positions.

Soil erosion has occurred in a substantial portion of Haliab, in the southeastern part of Egypt, due to the high erosivity of rainfall and runoff and to the abundance of steep slopes. Little is known about soil erosion by water in this area. The objectives of this study were : (i) to investigate the effect of water erosion and landslope positions on soil properties of Halaib area ,(ii) to describe the inherent susceptibility of soils to water erosion (soil erodibility) and changes in soil properties across landslope positions, and (iii) to determine the relationship between erosion severity and landscape positions.

MATERIAL AND METHODS

This research was conducted to study the changes of soil physical properties in relation to soil erosion in Halaib area in the southeastern part of Egypt. The area of study is located between latitude 22° and 24° N and longitude 35° and 37° E and far 34 km to the north of the Sudan. It borders Red Sea Coast in the east and Red Sea mountains chains in the west. This area is characterized as semi – arid. Rainfall is considered the most active erosion agent which falls in few storms causing surface flowing water with an energy strong enough to erode the soil . Meteorological data of Halaib are shown in

EFFECT OF EROSION AND LAND SLOPE POSITIONS ON SOME SOIL PROPERTIES IN HALAIB AREA

E.I Gaber *, A.S. El- Hassanin*, A. Ayoub **, and M.A. Darwish**

* Dept. of Natural Resources, Inst. of African Res. and Studies, Cairo Univ.
** Soil, Water and Environ. Res. Inst., Agric. Res . Center.

ABSTRACT

Soil erosion is a serious obstacle to agricultural development. Millions of tons of valuable rich and nonrenewable topsoil are lost annually to the drainage system. Soil properties become less favorable in eroded soils. Substantial portions of Halaib, in the southeastern part of Egypt, are exposed to the ravages of erosion.

The objectives of this study were: (i) to determine the extent and pattern of changes in soil properties as affected by water erosion across land slope positions, (ii) to relate changes in soil erodibility to changes in soil factors such as organic matter, particles sizes, soil structure and permeability, and (iii) to determine the relationship between soil erosion severity and land slope positions. Four wadis were chosen in Halaib area, i.e, sermatia, odiab, Doaet and Deep Craf to evaluate the impact of erosion on soil properties.

Results of grain size statistical parameters revealed that water action is the main factor affecting transportation and deposition of soil material. Combined action of water and wind appear in the surface layer of some soil profiles. Erosion resulted in changes in soil properties. Losses of fine soil particles, organic matter, and soluble cations and anions from the surface layer are frequent, especially on the upper reaches of slops. ER values (the ratio of soil constituent in the eroded sediments down slope to that in soil matrix) were more than one indicating the loss of these soil constituents in sediments downslope. Soil moisture retention was affected by soil erosion and landslope positions. Lower slope positions have been found to contain more available moisture than those of the higher positions. The differences in the soil moisture regime across the topographical position were mainly related to changes in soil properties, runoff, and infiltration parameters.

Soil erodibility index (K) ranged between 0.35 and 0.56. It decreased downslope. The variations in soil properties up – down stream lead to variations in K values which reflect the susceptibility of soils to erosion.

INTRODUCTION

Soil erosion is a dangerous phenomenon that reduces soil fertility and productivity in many African countries mainly by modifying certain soil properties. USDA (1981) listed loss of plant available soil water capacity, loss of plant nutrients, degradation of soil structure (surface sealing and crusting), and nonuniform removal of soil within a field as ways in which erosion decreases soil productivity. Tons of valuable rich topsoil are lost annually to

طريقة تكنولوجية جديدة للحصول علي سيليكا نقية من سرس الارز

عاصم محمود حسين ، محمد هشام ياسين
كلية العلوم – بنها – جامعة الزقازيق

الملخص

تم استخلاص السيليكا من سرس الأرز بتسخينها فى الأوتوكلاف لمدة ساعة عند درجة حرارة ١٣٥°م فى محلول صودا كاوية تركيز ١٧ % بنسبة ٧ : ١ وزن / حجم . أحتوى السائل الأسود المتكون على ٢٢٨ جم سيليكا / ١كجم من سرس الأرز . تم فصل السيليكا من السائل الأسود بمعاملة السائل الأسود بحامض أيدروكلوريك ١٠ % وقد استخدم لمنع تكوين جل إضافة ٤,٥ % كلوريد الصوديوم لكل ١٠٠ مل من السائل السود وذلك لمعادلة الشحنة الكهربية علـى أيونات $(Si_2 O_3)^{3-}$ ومن بين الإلكتروليتات المجربة – أحادية ، ثنائية ، ثلاثية التكافؤ – تبين أن أنسبها كان كلوريد الصوديوم لمعادلة شحنات $(Si_2 O_3)^{3-}$ كانت السيليكا التى تم الحصول عليها بيضاء اللون وقد نقيت بالغسيل بالميثانول ثم الماء .

درست حواص طيف الامتصاص وتبين وجود قمة امتصاص عند طول موجة ٢٠٥ ن م فى الأشعة الفوق بنفسيجية وعند طول موجة ٤٦٥ ن م فى الأشعة تحت الحمراء ، كما درست خواص السيليكا فى الطيف الكتلى . كما تبين ان للسيليكا التى تم الحصول عليها الخواص الآتية : مساحة سطح ٣٦,٥م^٢ / جم . السعة لطبقة الأولى ١٥٩، حجم ثقوب ٦٨أ° . أدى فحص طيف الأمتصاص فى الأشعة تحت الحمراء ، طيف الكتلة وتحليل العناصر للسيليكا إلى ان المركب المدروس هو حمض هيدروسيليسيك .

Yoshido, S.; Y. Ohnishi and K.Kitagishi (1962a) : Chemical forms, mobility and deposition of silicon in rice plant . Soil Sci, plant. Nutr. (Tokyo)8., 15
.

Yoshido, S.; Y.Ohnishi and K.Kitagishi (1962b) : " Chemical forms of silicon in rice plant ", New method for determining the localization of silicon within plant tissues. Soil Sci. Plant .Nutr. (Tokyo) 8, 30.

Yoshido, S.; Y. Ohnishi and K.Kitagishi (1962C) : " Histochemistry of silicon in rice plant ". II. Localization of silicon within rice tissues. Soil Sci . plant. Nutr. (Tokyo) 8, 36 .

REFERENCES

Amick, J.A.(1982) : Purification of rice hulls as a source of solar grade silicon for solar cells .J. Electrochem. Soc. 129 : 864 – 866.

Brunauer, S.; B.H. Emmett and E. Teller (1938) : Amer . Chem. Soc. , 66 (1938) 309 .

El-Sayed, H.;A.E. El Ashmawy and M.A. Hammad (1980). Silica reduction of rice hulls. Pages 363 – 368 in : waste treatment and utilization theory and practice of waste management, Vol. 1. M. Mooyoung and G.J. Forquhor, eds pergman press, Oxford.

Fridrikhsberg, D.A. (1986) : A Coarse in colloidol chemistry. Mir publishers, Moscow .

Hanna, S.B.and N.M. Ghoneim (1986) : Formation of B-Sialon for kaolin and rice hulls. Interceram., 35 : 5 – 42 .

Hussein, A. M.; H. El-Said and E.S. Yasin (1992) : Bioconversion of hemicelluloses of rice hulls black liquor into single cell protein , J. Chem. Tech. Biotechnol, 53. 147 – 152 .

Ibrahim, M.N.M. (1983) : Physical, chemical, physico – chemical and biological treatments of crop residues pages 53 – 68 in : The utilization of Fibrous Agricultural Residues . Aust. Deu. Assistance Bur. Res. Deu. Seminar , Los Banos, Loguna, philippines, 1981. G.R. Peorce, ed. Aust . Gont, Publ. Serv., Canberra .

Iengar, N.G.C.; G. Rajendram; K.M. Yusuff and G.Basheer (1978) : Industrial utilization of paddy husk. Improved methods for extraction of silicate and activation of the carbon. Pages 79 – 96 in : Rice Report 1977 . S. Barber, H. Mitsuda, H.S. R. Desikachar and E. Tortpsa, eds . Inst. Agroquim . Technol . Aliment., Valencia, Spain .

Jackson, M.G. (1977) : Review article : The alkali treatment of straws . Anim. Feed Sci. Technol. 2 : 105 – 130 .

Lanning, F.C. (1963) : Silicon in Rice. J.Agr. Food. Chem., 11, 435 .

Lee, T.G. and I.B. Cutler (1975) : Formation of silicon carbide from rice hulls. Ceram. Bull., 54 : 8 – 195 .

Liu, S.L. (1960) : HO – C – H nature of the silicon in rice husk . 1 – Solubility of the silicon . J. Chinese chem. Soc. (Tawin) 6, 141, 1960. Chem . Abst. 55, 467 3b (1961) .

Liu, S.L. (1961) : The nature of silicon in rice hulls. II – polymerizing tendency of the dissolved silanolates, J. Chinese Chem. Soc., ser. 1, 8, 1961. Chem. Abst. 58 , 82349 (1963) .

Mehta, P.K.and N.Pitt (1977) : A new process for rice husk utilization . pages 45 – 58 in : proc. Rice By – products utilization Int. Conf., Valencia, spain, 1974 .Vol. 1. Rice Husk utilization ,S.Barber and E. Tortosa, eds. Inst. Agroquim . Technol. Aliment., Valencia.

Sharma, N.K.; W.S. Williams and A.Zongvil (1984) : Formation and structure of silicon carbide whiskers from rice hulls. J. Am. Ceram. Soc., 67 : 20 – 715.

Sterling, C.(1967) : Crystalline silica in plants. Am . J. Bot. 54, 340 .

Yasin, E.S. (1993) : Nonconventional uses of Rice hulls, Ph. D. Thesis : Botany Department, Faculty of Science, Zagazig Univ., Benha branch.

Yoshido , S. ; Y. Ohnishi and K.Kitagishi (1959) : The chemical nature of silicon in rice plant soil and plant food (Tokyo), 5, 23 .

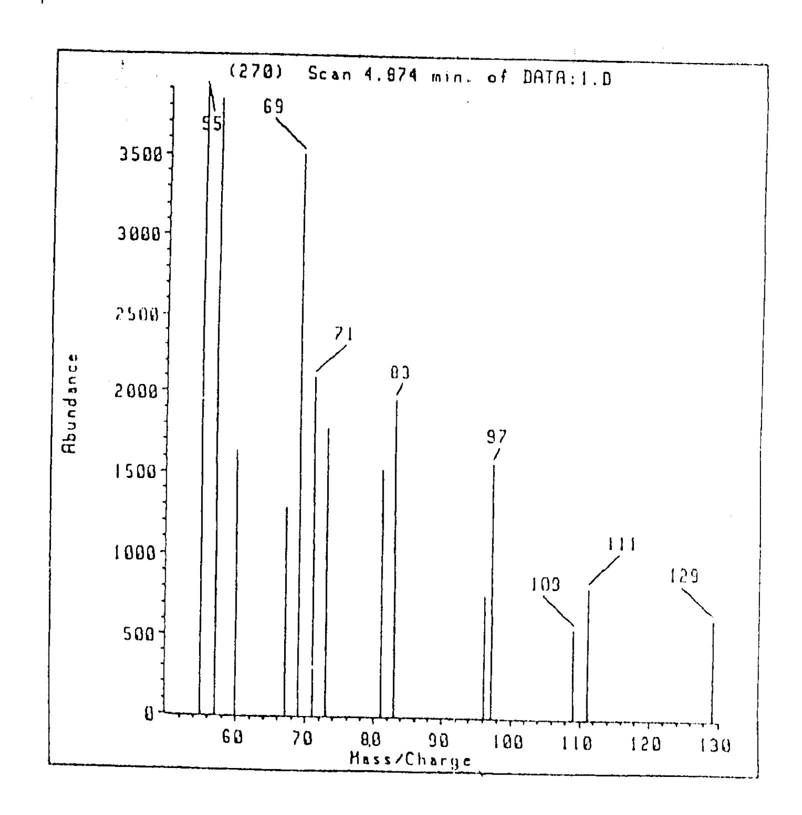
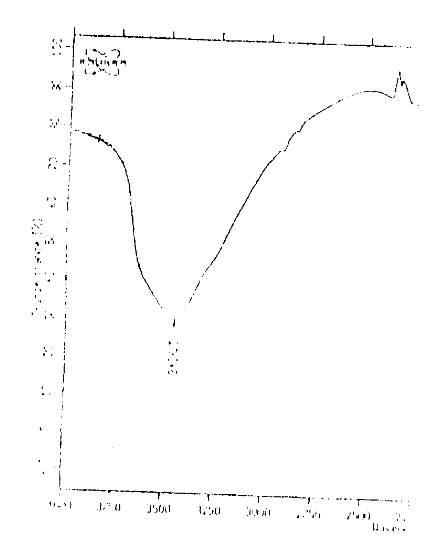


Fig (4) Mass Spectrum of purified silica



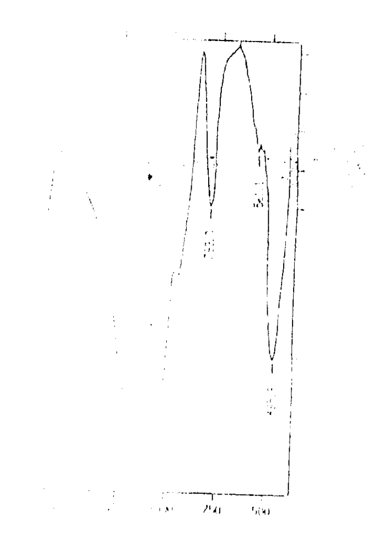


Fig (3) IR Spectrosc

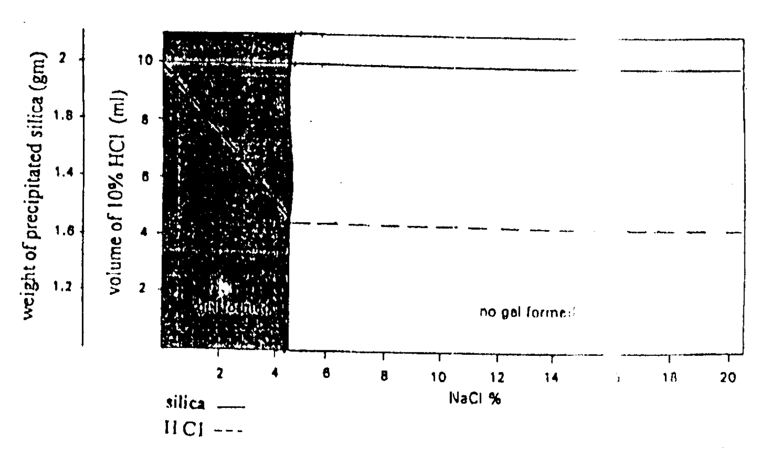


Fig. (1) Use of NaCl for silica precipitation from black liquir (combined work)

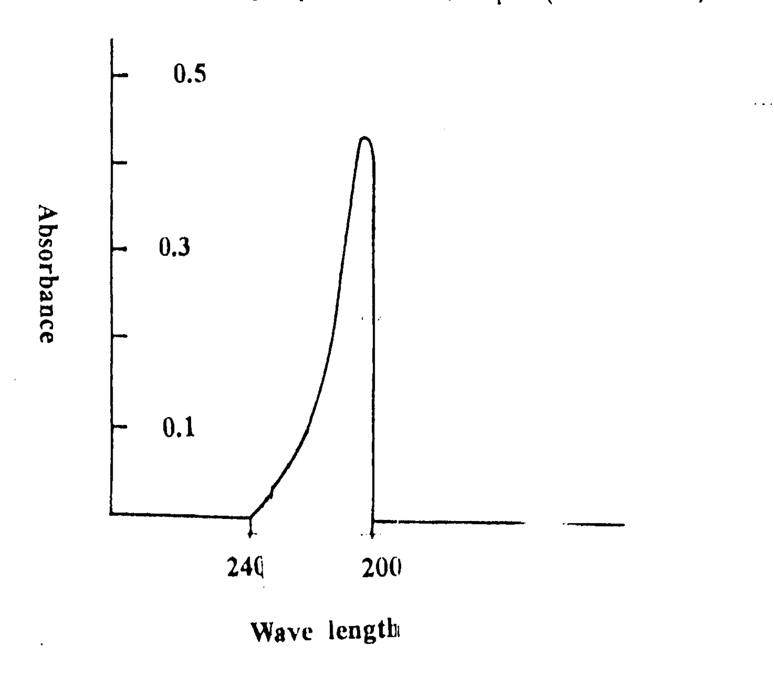


Fig (2) UV Spectrum of purified silica

(rice hulls) per each patch confirmed the efficiency of NaCl as antigelling factor .

The obtained silica precipitate contains mainly organic impurities (lignin and hemicelluloses). Several trials were carried out for silica purification, the best of which proved to be the repeated dissolution in NaOH followed by precipitation . This enabled obtaining silica with minor inorganic impurities. The purity of obtained silica was shown by IR Spectroscopy. The obtained silica showed more or less satisfactory physical characteristics as indicated by surface area, monolayer capacity and pore size parameters. These characteristics are considered satisfactory green light for scaling up the production of silica precipitates from rice hull black liquor .

The IR spectra of the silica of rice hulls was measured in KBr disc. The spectrum is shown in Fig . (3) .

Inspection of the IR chart shows a broad band at 3456 cm^{-1} which is due to the presence of water of hydration, while the strong, band at 1090 cm^{-1} is due to the stretching vibration of Si – O ($\square_{SiO}$)of the silicate ion. The medium band at 799 cm^{-1} is due to the bending vibration of O – H group ($\square_{OH}$)while the strong band at 465 is due to bending vibration of Si – O group. This suggests that the compound present is $H_3\ Si_2O_3.\ H_2O$ (hydrosilicic acid) . This is confirmed by the mass spectra of the compound obtained, the parent peak gave molecular weight and relative abundance as shown in table (5) from which it is clear that the molecular weight of the parent compound is 125 which is corresponding to $H_3\ Si_2O_3.\ H_2O$.

Table (5) : M / Z of silica followed by the abundance %

M / Z	Abundance %	M / Z	Abundance %
55	100	81	39.06
57	98.23	83	50.31
60	41.88	96.15	19.5
67	32.85	97.15	40.16
69	89.8	109.15	14.22
71	53.79	111.15	20.73
73	45.57	129.15	15.84

According to mass spectra , the degradation of the compound is suggested to be :

$$H_3Si_2O_3.\ H_2O.\ H_2O \overset{?18}{\underset{?H_2O}{?}} H_3Si_2O_3 \overset{?18}{\underset{?H_2O}{?}} HSi_2O_2\ ?\ SiO_2$$

125   107   99   60

This structure was furthery confirmed by elemental analysis where it was found that the percent of water obtained by heating the sample at 120° for 2 hours is 14.22% (calculated 14.44 %) . When the sample is ignited at 700°C, the metalic residue of SiO_2 was found to be 47.62 % (calculated 48.01 %) .

Elemental analysis :

Elemental analysis showed traces of carbon, hydrogen and nitrogen .

Mass Spectrum :

Fig (4) showed that molecular weight of silica equal to 129

Adsorption desorption isotherm :

The data of adsorption desorption isotherm given in table (4) for the purified sample of the obtained precipitated silica show that the process of purification greatly improved the surface characteristics of the studied silica samples. Thus surface area was 36.5 m^2/g for the purified sample, Monolayer capacity was 159 and pore size was 68A° .

Table (4) Adsorption and desorption isotherm of obtained silica:

Parameter	Purified silica
Surface area	36.5 m^2/g
Monolayer capacity	159
Pore size	68 A°

DISCUSSION

Difficulties encountered in the extraction of silica :

Silica is highly soluble in the highly alkaline black liquor. The conventional methods of the desilication of black liquor rely on the neutralization by mineral acids – sulphuric or hydrochloric – to a pH of 9 – 8 where silica converts into silicic acid which settles down in the form of a gel

The main disadvantages of such methods are :

1 – High cost as great amounts of mineral acids are needed for neutralization .
2 – Gelation of silica which leads to purification problems due to the adsorption of a lot of lignin and hemicelluloses .
3 – These difficulties of purification of crude silica require tedious and expensive methods of purification .

As a result of rice hull desilication a viscous black liquor is obtained which contains silica (20 %), lignin (9.8 %) and hemicelluloses (25 %) . These results are in agreement with those reported by Yasin (1993) .

A nonconventional method of extraction of silica from black liquor was worked out. This method depends on the use of certain electrolytes of antigelling and coagulating properties for the precipitation of silica. NaCl (0.5 %) which succeeded to act as excellent antigelling and coagulating substance. Fridrikhsberg (1986) suggested the addition of electrolytes to gel to help coagulation as a result of the neutralization of surface charge of gel particles. Scaling up precipitation trials to the level of black liquor obtained from 10Kg

Multitreatment by NaOH for purification of silic[illegible]

Samples of the obtained crude precipitated s[illegible]ca, usin[illegible] [illegible]% NaCl and 10% HCl, were dissolved in 17 % NaOH solution a[illegible] 135°C f[illegible] [illegible] hour . The produced cool solution of sodium silicate was filter[illegible], silica p[illegible]pitated using 5% NaCl and 10 % HCl. The obtained silica precipit[illegible]e was wa[illegible]d thoroughly by distilled water and dried at 105°C for six hours . This pro[illegible] was repeated once more for further purification . The purified s[illegible]ica by th[illegible] method had a clear white color and fine powdery texture .

Inorganic impurities of silica samples :

Crude purified silica does not co[illegible] any [illegible] as we[illegible] Zn . The contents of Cu[illegible] and [illegible] lower than th[illegible] for th[illegible] [illegible]de sample. However, Ca is slightly higher in the puri[illegible]d sample. Silic[illegible] [illegible]ntent of the purified sample is greater compared to the crude sam[illegible]le

Table (2): Inorganic impurities of the obtained silic[illegible]

metal	Content in (mg[illegible]g)	
	Crude silica	Puri[illegible]d silica
Si	748.0[illegible]	[illegible]
C[illegible]	0.4[illegible]	[illegible]
Ni	0.00	[illegible]
Cu	0.48	[illegible]
Zn	0.00	[illegible]
Fe	64.28	[illegible]26
Mg	2.78	[illegible]

Silicon [illegible]timated as SiO_2 Using aqua regia

Characterization of produced preci[illegible]itated si[illegible]

UV. Spectroscopy

Purified silica showed a single peak of abs[illegible]ption [illegible]a at 205 nm (Fig. 2)

IR Spectroscopy :

It is shown in fig. (3) an[illegible] (3) summari[illegible]d the [illegible] of the studied silica and indicates their related function groups .

Table (3) : IR Spectroscopy of purified Silica

Function group	Frequency [illegible]m⁻¹
Water	3[illegible]6
Stretching Si-O	1[illegible]0
Bending O-H	[illegible]
Bending Si-O	[illegible]

14.0, 16.0, 18.0 and 20.0 % . The addition of only NaCl to any of the used concentrations did not cause the precipitation of silica. Then , 10% HCl, was dropewise pipetted into the flasks till on shaking silica precipitation took place. Flasks were kept still for one hour for further silica settling . The used volumes of 10% HCl were recorded for each NaCl concentration . Silica was centrifuged, washed several times, filtered and its oven dry weight was recorded.

The 4.5 % NaCl concentration (Fig.1) was found to be the threshold concentration of coagulation i.e. prevention of gelation of silica particle and formation of precipitate . Below such concentration silica gels i.e. gel formation took place .

Efficiency of the use of NaCl for precipitation of silica from black liquor

Scaling up of eight patches were carried out at the scale of 10 Kg per each patch. The resulting black liquor was desilicated and delignifited following the before mentioned technique . In addition of sodium silicate the black liquor contained appreciable amount of lignin in the form of sodium ligninate .

The data given in table (1) of the results of eight patches of treatment, (each patch of 10 Kg of crude rice hulls) using NaCl as well as HCl showed that on the average the obtained black liquor for each patch was 47L which contained 1.280 Kg of silica and about 0.749 Kg of lignin . These data confirms the suitability of suing NaCl as coagulating agent for the precipitation of silica and hence fractionation of black liquor .

Table (1) : Efficiency of the use of NaCl for the precipitation of silica from black liquor :

Patch No.	Bl volume (1)	W. Silica (gm)	W. lignin (gm)
1	47.56	1250	750
2	47.23	1300	750
3	48.05	1300	780
4	48.65	1330	850
5	43.17	1300	700
6	49.39	1200	750
7	46.73	1250	700
8	45.14	1300	700
Average	46.99	1279	748

The Use of mono, divalent and trivalent electrolytes for the precipitation of silica :

Yasin (1993) tried the use of mono, di – as well as trivalent electrolytes NaCl, $CaCl_2$, $BaCl_2$, $AlCl_3$ and $FeCl_3$ for the precipitation of silica of rice hulls from black liquor and found that di and trivalent electrolytes cannot be used for such purpose as they form insoluble hydroxides on their addition to the highly alkaline black liquor

dissolved in 1.5 ml of HF and completed to 27 ml by distilled water . Z-6100 polarized Zeeman Atomic absorption spectrophotometer was used for the determination of some mineral content.

Mass Spectrum :

Mass spectrum was determined at microanalytical center, Cairo University .

Adsorption desorption isotherm :

Adsorption desorption isotherm was performed at physical chemistry Lab., National Research center using BET method (Brunauer et al, 1938)

RESULTS

Desilication of rice hulls :

Different desilication treatments of rice hulls was worked out. El-Sayed et al (1980) using a series of concentrations of NaOH (4% , 8%, 12%, 17% or 20 %) found that 17 % was the most suitable NaOH concentration for desilication . Using this NaOH concentration best desilication of rice hulls was achieved at 135°C for one hour.

Black Liquor from Rice hulls :

The desilication process of rice hulls black liquor was carried out at the rate of 5L per each Kg of rice hulls.

Several workers on the desilication of rice hulls reported that the main components of black liquor (Jackson, 1977; Ibrahim , 1983) resulting from the NaOH treatment of rice hulls are : a) Sodium silicate b) Sodium ligninate and c) hemicelluloses (Pentoses & hexoses).

The desilication of one Kg of crude rice hulls by 17 % NaOH, at the rate of 1 : 7 W/V for one hour at 135°C yielded 588.3 gm of residual desilicated rice hulls, 5.04L of black liquor which contained solids 438.02 gm (sodium silicate + sodium ligninate + hemicelluloses) which contained 228.6 gm of ash and 230.42 gm of lignin plus hemicelluloses .

Silica from Rice hulls black liquor :

Alkali treatment of rice hulls converts insoluble form of silica within rice hull tissue into soluble sodium silicate .

Coagulation of silica gel using NaCl :

Series of 250 ml capacity flasks each having 100 ml of black liquor to which different amounts of NaCl was added to achieve the following NaCl concentrations : 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 6.0, 8.0, 10.0, 12.0,

Iengar et al, (1978) worked out another techniques of silica isolation, silica are extracted from the ash , even at ambient temperature, after standing for several hours in 5% NaOH solution. Purification is another important process after isolation of silica. Amick (1982) reported a procedure for purifying rice hulls to be used as a source of solar – grade silicon for solar cells.

This paper aims at extraction of silica from rice hulls, purification and characterization.

MATERIALS AND METHODS

Preparation of black liquor from rice hulls

One kg of rice hulls was mixed with 7L of water and 175g of solid sodium hydroxide in well plugged 20 L capacity flask. The flask was autoclaved for one hour at 1.5 atmosphere . The black liquor was obtained by filtration through cotton gauze

Studies on silica

Raw material:

Rice hulls were purchased from El-Sharkia rice mill, Zagazig .

Desilication of black liquor:

The method adopted by Hussein et al (1992) was followed :
To 1L of black liquor 5 % NaCl W/V were added and stirred tille complete solubilization then 95ml. of 5 % HCl were added gradually. The mixture was left overnight till complete precipitation of silica which was removed by filtration and washed several times then dried and harvested .

UV Spectrophotometry :

Perkin – Elmer Lambada 3B UV / VIS spectrophotometer was used.

IR Spectrophotometry :

IR spectra in KBr were recorded on a Shimadzu. JH- 470 spectrophotometer.

Elemental analysis :

Carbon, hydrogen and Nitrogen percent were determined at microanalytical center , Cairo University.

Atomic absorption :

Procedure : 0.01 g of crude as well as purified silica sample were

NONCONVENTIONAL TECHNIQUE FOR OBTAINING PURE SILICA FROM RICE HULLS

Assem M.Hussein and Mohamed H. Yasin
Benha faculty of science, Zagazig University

ABSTRACT

Silica was extracted from rice hulls by autoclaving at 135°C in 1: 7 W/V 17 % NaOH for one hour. The formed black liquor contained 228 g silica / 1 kg of rice hulls. Silica was separated from black liquor by neutralization using 10 % HCl. However, for preventing gelling of the black liquor, 4.5g of NaCl / 100 ml of black liquor were added to neutralize the charges on $(Si_2O_3)^{3-}$ Of different electrolytes tested – mono, di and trivalent- NaCl proved the best for neutralization. Silica was obtained as white ppt and purified by washing with methanol

The following physical characteristics of silica were studied : in UV a peak of maximum absorption was detected at 205 nm , while in IR a peak at 465 cm^{-1} indicating SI-O group. Other characteristics of silica were studied by mass spectra. The purified silica showed surface area of 36.5 m^2/g, monolayer capacity of 159, pore size of 68 A° . Inspection of the IR chart of silica, mass spectra and elemental analysis. These suggest that the compound present is $H_3Si_2O_3$. H_2O (hydrosilicic acid).

INTRODUCTION

Silicon in the rice hulls, apparently occurs as a hydrated amorphous form of silica, whether it is opal or silica gel is a question still not completely answered, though the evidence for the opaline form is rather strong .(Lanning, 1963 and Sterling, 1967). There is a quite general agreement that the silica is predominantly in inorganic linkages, Liu (1960 and 1961) affords some evidence from solubility studies that a part of the silica might be tied with organic groups. Yoshido et al (1959, 1962a ,1962b and 1962c) found no evidence for organosilicon compounds by studying IR spectra . They concluded that silicon is taken up and transported in the plant as mono – silicic acid

Silica concentrates in the outer dentate crust and inner luminal surface layer of the rice hulls and is delicately dispersed between the two .

Most o the industrial uses of rice hulls pertain to the silica present in it. These the development of ceramics such as silicon carbide and silicon nitrate (Lee and Cutler, 1975 ; Sharma et al, 1984 ; Hanna and Ghoneim, 1986).

The amorphous, highly reactive silica, obtained from ash burned at 700°C or below, is a suitable raw material for cement binder and ultra – pure silica (Mehta and Pitt, 1977).

Wood, D. and Lenne, J.M. (1997). The conservation agrobiodiversity on farm: questioning the emerging paradigm. Biodive y and Conservation 6, in press.

Janzen, D.H. and Gamez, R. (1997). Assessing information needs for sustainable use and conservation of biodiversity. In: Hawksworth, D.L., Risk, P.M. and Clarke, S.D. Biodiversity Information Needs and Options, pp.21-29. Proceedings of the 1996 International Workshop on Biodiversity. CAB International.

Kuchier, A.W. (1964). Potential Natural Vegetation of the Conterminous United States. Special publication No.36. New York: American Geographical Society.

Maguire, D.J., Goodchild, M.F. and Rhind, D.W. (1991). Geographic Information Systems. Longman, London, 2 volumes.

Marqules, C.R. andAustin, M.P. (eds.) (1991). Nature conservation: cost effective biological surveys and data analysis. CSIRO, Australia.

McGranaghan, M. and Wester, L. (1988). Prototyping an herbarium collection mapping system. Technical papers of the 1988 ACSM-ASRRS. Annual Convention, vol.5: 232-238. St. Louis, Mirsouri, 13-18 March 1988.

McNEEly, J.A. (1994). Protected areas for the 21st century: working to provide benefits to society. Biodiversity and Conservation 3 :390-405.

Morse, L.Z., Henifin, M.S., Ballman, J.C. and Lawler, 3.I. (1981). Geographical data organization in botany and plant conservation: a survey of alternative strategies. In : Morse, L.E. and Henifin, M.S Rare Plant Conservation: Geographical Data Organization, pp.9-29. Bronx, New York: the new York Botanic Garden.

Omernik, J.M. (1987). Ecoregions of the conterminous United States. Annuals ofthe Association of American Geographers. pp.77-118.

Perring, F.H. and Walters, S.M. (1 962). Atlas ofBritish Flora. London, Nelson and Sons.

Scott, J.M., Davis, F., Csuti, B., Noss, R., Butterfield, G.C., Anderson, H. Caccio, S., D'Erchia, F., Edwards, T.C., Ulliman, 3. and Wright, R.G. (1993). Gap analysis: a geographic approach to conservation of biological diversity. Wildlife Monographs, 123:1-41.

Scott, J.M., Tear, T.H. and Davis, F.W. (1996). Gap Analysis: A Landscape Approach to Biodiversity Planing. MD. American Society for Photogrammetry and Remote Sensing, Maryland, USA. Spellerberg, I. F. and Sawyer, W.D. (1 999). An Introduction to Applied Biogeography Cambridge University Press. Pp 243.

Stein, B.A. (1998). Designing information systems to support biodiversity conservation. In: awksworth, D.L., Kirk, P.M. and Clarke, S.D. (eds.), Biodiversity Information Needs and Options, pp.5-20. Proceeding of the 1996 International Workshop on Biodiversity Information. CAB International.

Tuomisto, H. Ruokolainen, K., Kalliola, R., Linna, A., Danjoy, W. and Rodriguez, Z. (1995). Dissecting Amazonian biodiversity. Science 269 : 63-66.

UNEP (1992). Convention on Biodiversity. UNEP Environmental Laws and Institutions Programme Activity Center, Nairobi, Kenya.

Walker, P. and Faith, D.P. (1993). Diversity : a software package for sampling phylogenetic and environmental diversity. Division of Wildlife and Ecology, CSIRO, P.O. Box 84, Lyneham, Act 2602, Australia.

LIST OF USEFUL READINGS

Aspinall, R.J. (1995). Geographic information systems: their use for environmental management and nature conservation. Parks vol.5 No.1 :20-31.

Ayyad, M. (1998). Multipurpose Species in Arab African Countries. UNESCO Cairo Office. Pp 90. Bailey, R.G. (1 976). Ecoregions ofthe United States. Oqden. Utala : VSPA Forest Service.

Boulous, L. (1995). Flora ofEgypt (Checklist). Al-Hadara Publishing.

Bridgewater, P.B. (1993). Landscape ecology , geographic information systems and nature conservation. In: Haines-Young, R., Green, D.R. and Cousins, S. (eds.). Landscape Ecology and Geographic Information Systems. pp.23-36. Taylor and Francis, London.

Canhos, V.P., Manflo, G.P. and Canhos, A. Networks for distributing information. In: Hawksworth, D.L., Kirk, P.M. and Clarke, S.D. (eds.), Biodiversity Information Needs and Options, pp.5-20. Proceeding of the 1996 International Workshop on Biodiversity Information.

CAB International. Crumpacker, D.V., Hodge, S.W., Friedley, D. and Gregg, W.P. (1988). A preliminary assessment of the status of major terrestrial and wetland ecosystems on Fedral and Indian lands in the United States. Conservation Biology 2:103.

Davis, F.W., Stoms, D.M., Estes, J.E., Seepan, J. andScott, J.M. (1990). An information systems approach to the preservation of biological diversity. International Journal Of Geographic Information Systems, vol.4, No.1:55-78

El-Hadidi, MN., Batanouny, KH. and Fahmy, A.G. (1991). The Egyptian Plant Red Data Book. UNEP, Cairo University. Faculty of Science.

Estes, J.E. (1995). The need for improved information system. Canadian Journal ofRemote Sensing 11:124.

Faith, D.P. andWalker, P.A. (1996). Environmental diversity: on the best possible use of surrogate data for assessing' the relative biodiversity of sets of areas. Biodiversity and Conservation 5: 399- 415.

Harrison, J. (1995). Finding the information. Parks, volS No *:12- 19.

Hawskworth, D.L. (1992). Litmus test for ecosystem health: the potential of bioindicators in the monitoring of biodiversity. In: Swaminathan, M.S. and Jana, S. (eds.). Biodiversity, Implications for Global Food Security, pp.184-204. Macmillan Indrei.

Heywood, V.H. (1997). Information needs in biodiversity assessments : from genes to ecosystems. In: Hawksworth, D.L., Kirk, P.M. and Clarke, S.D (eds.), Biodiversity Information Needs and Options, pp.5-20. Proceeding of the 1996 International Workshop on Biodiversity Information. CAB International.

IUCN (1993). Parks for life. Report of the IVth World Congress on National Parks and Protected Areas. IUCN, Gland, Switzerland. VII +260 pp.

Janzen, D.H. (1993). Taxonomy : universal and essential infrastructure for development and management of tropical wildland biodiversity. In: Sandlund, O.T., Hinder, K. and Brown, A.H.D. (eds.). Conservation of Biodiversity for Sustainable Development, pp. 100-113. Scandinavian University Press, Oslo.

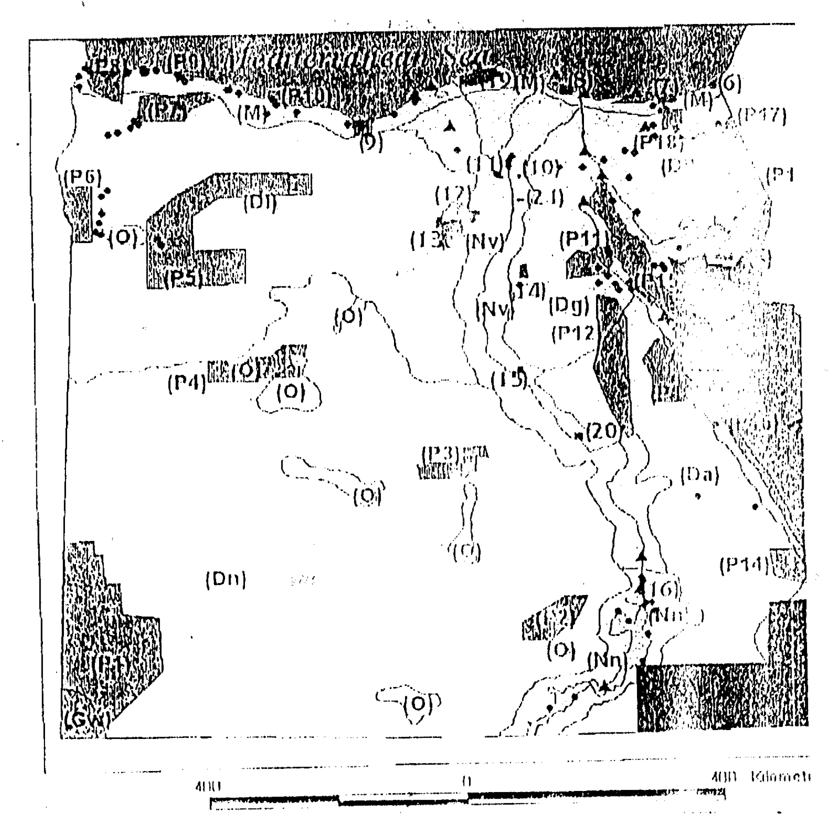


Figure (7): The Distribution of Threatened Arboreal Species, the Phyt
Subdivisions and Protected Areas (established and p
Overlayed on the Important Bird Areas (IBA)

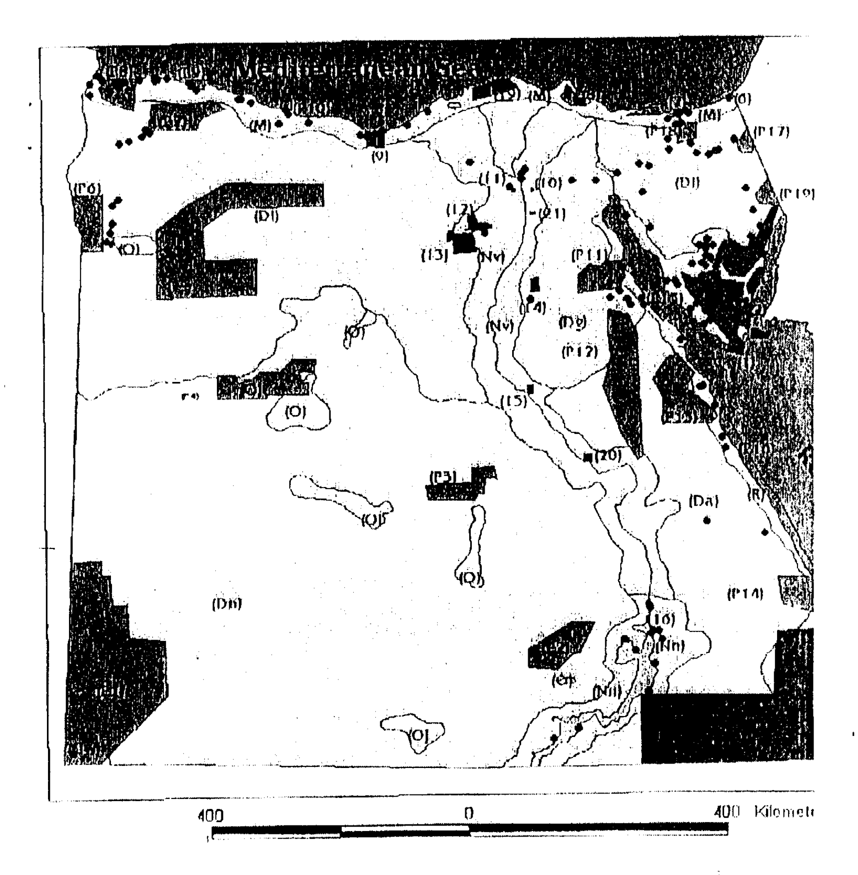


Figure (6): The Distribution of Threatened Arboreal Species and the P
Subdivisions Overlayed on Protected Areas (established a

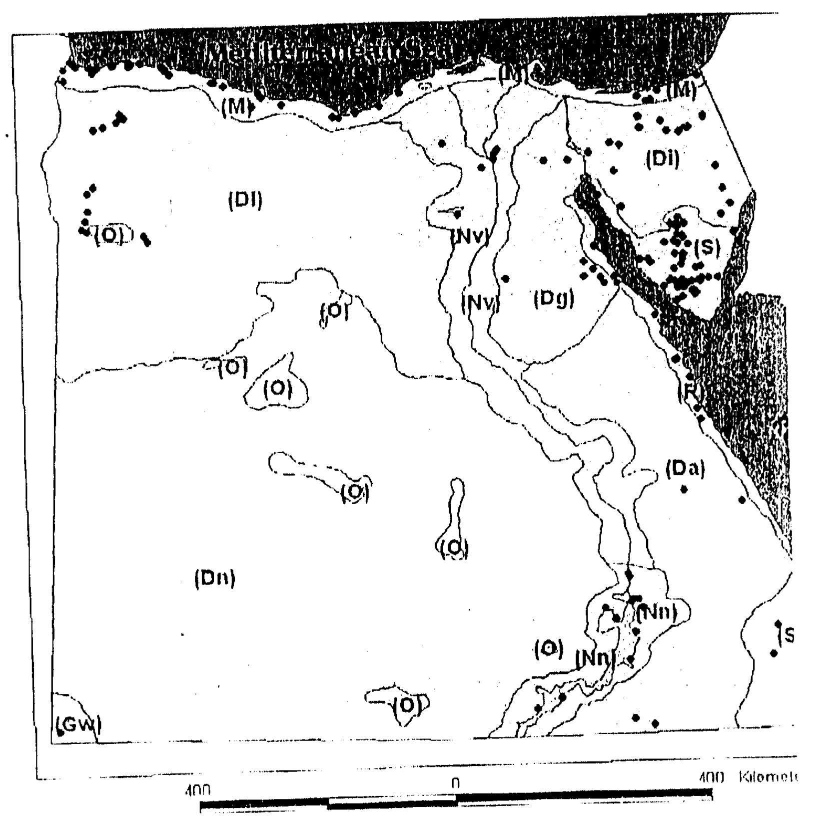


Figure (5): The Distribution of Threatened Arboreal Species Overla on the Phytogeographical Subdivisions.

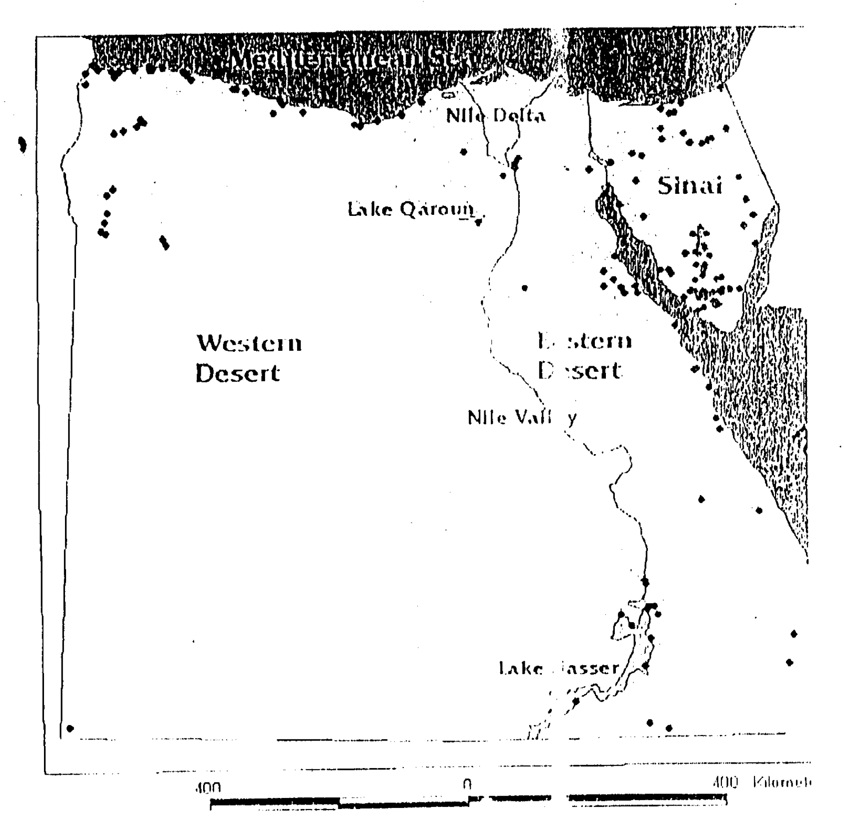


Figure (4): The Distribution of Threatened Arboreal Species In Egypt (as listed In the Egyptian Red Data Book).

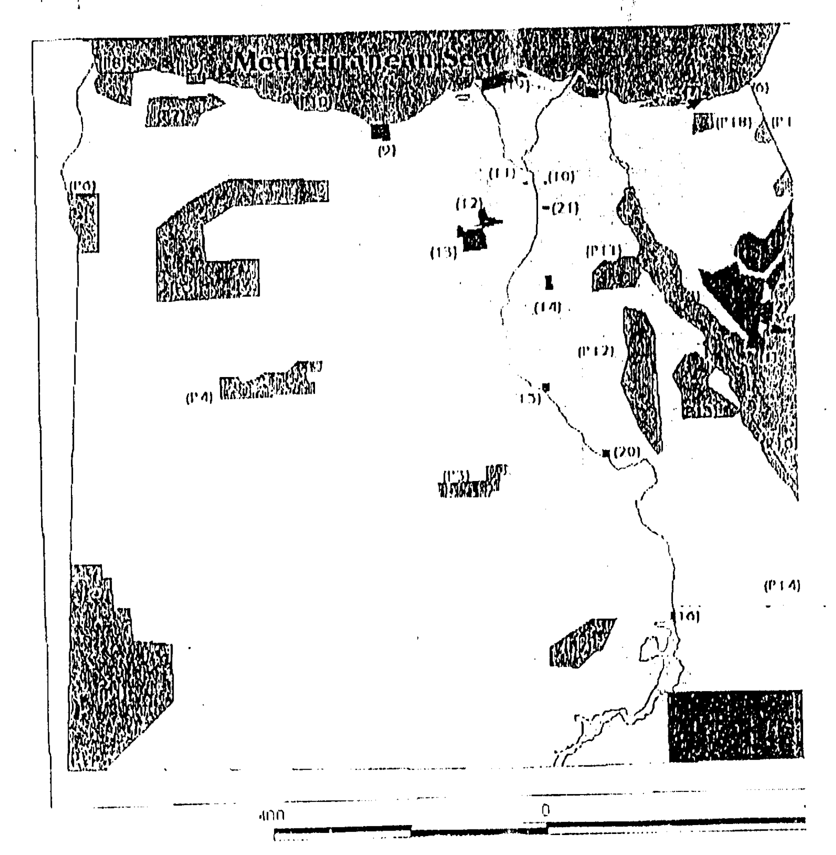


Figure (3): The Distribution of Protected Areas (established and prop

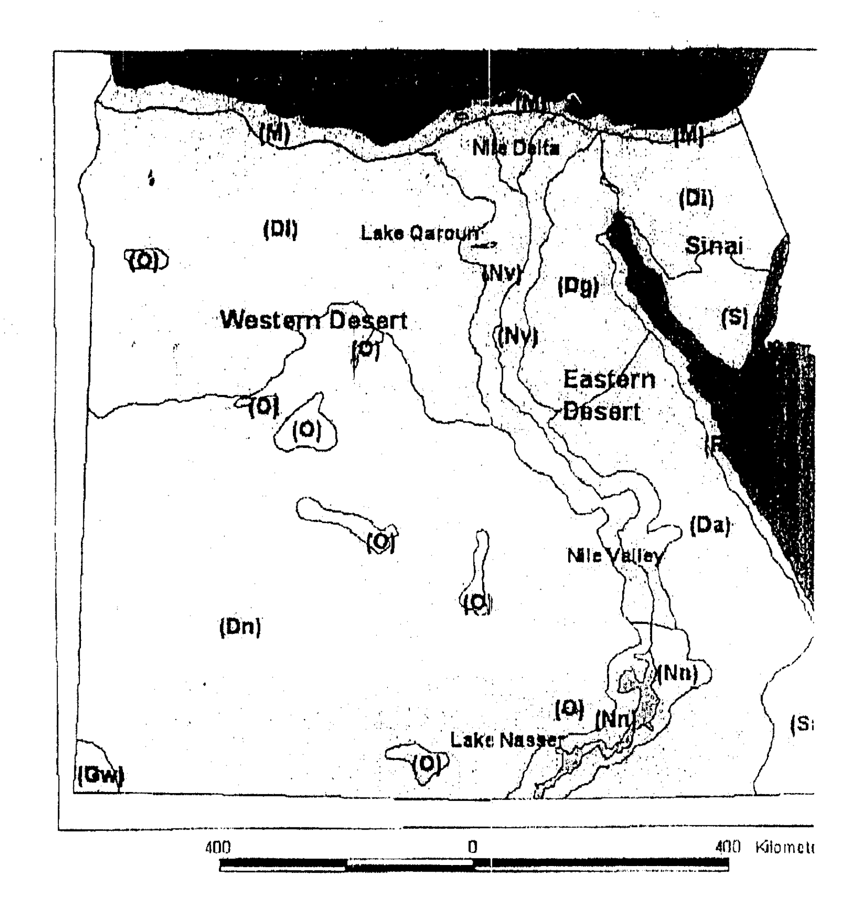


Figure (2): The 'Phytogeographical Subdivisions' of El-Hadidi *et a*

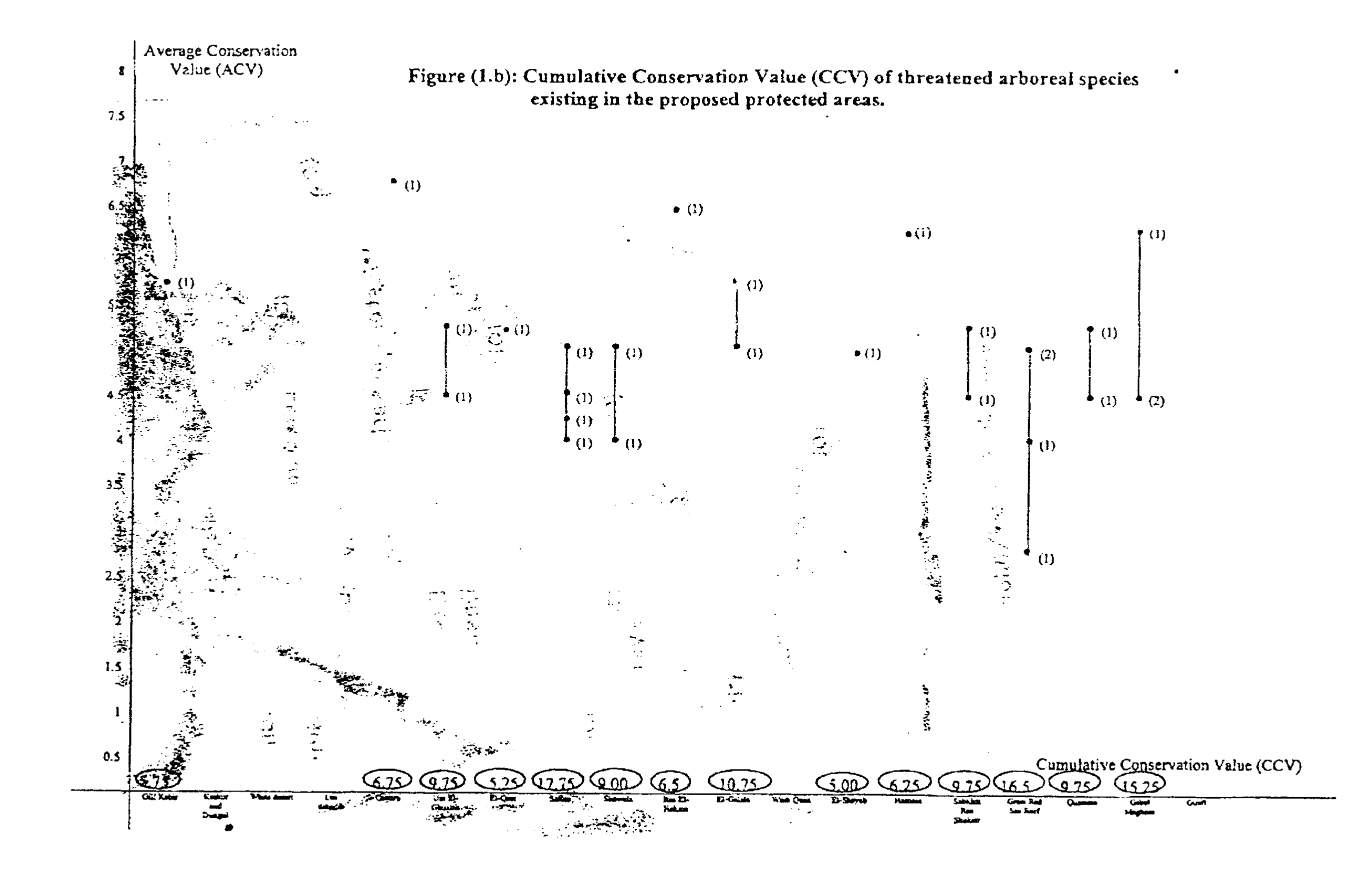


Figure (1.b): Cumulative Conservation Value (CCV) of threatened arboreal species existing in the proposed protected areas.

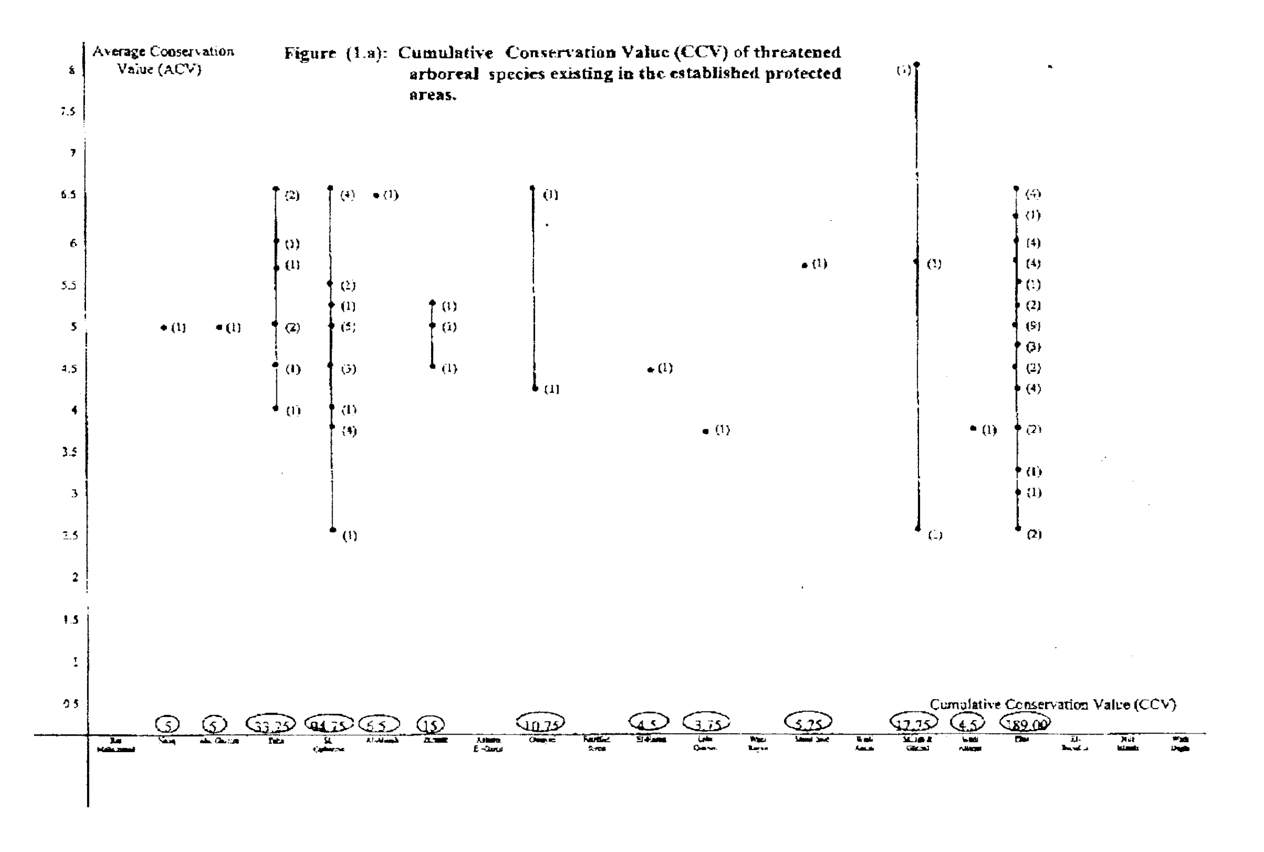


Figure (1.a): Cumulative Conservation Value (CCV) of threatened arboreal species existing in the established protected areas.

reposition them so that they may fit with the identified hotspots. This analysis also reveale that there are gaps in the network of protected areas, e.g. northern and eastern Sinai, Isthemic desert and Nubian Nile subdivision, it could then be appropriate to consider these gaps in the formation of national strategy action plan of biodiversity conservation.

CONCLUSIONS AND RECOMMENDATIONS

1- The present study proposes guidelines for a model framework of a comprehensive biodiversity information system. More information on other biota may be included. Data of other species (flora and fauna) should be treated the same way and be compiled in a national GIS-based system. By overlaying all the data on living organisms and their spatial distribution, a clear understanding on the status of biodiversity in Egypt could be gained, and better decisions could be made regarding biodiversity conservation. The achievement of this goal would represent the real wealth of the country in terms of its biological currency.

2- The declared network of protected areas in Egypt (21) confers relatively adequate representation of its phytogeographic subdivision. However, the threatened arboreal species that occur in the Mediterranean and western desert need urgent conservation actions by establishing protected areas and encouraging the declaring the proposed protected areas; Sallum, Great Red Sea Reef and Gebel Maghara.

3- Gebel Elba and Sinai protected areas play a significant role in conserving the threatened arboreal species of Egypt (attaining highest species richness, including most of the endemic species, and representing internationally important bird areas). This calls for efficient management plan for each of these two protectorates that ensure coherent conservation actions, and that these protectorates could be used as centers of environmentally research activities. It is recommended to establish bird watching areas in these protected areas to enhance ecotourism.

4- The use of GIS is recommended as an effective approach more so than either manual methods or non-spatial automated means of making biodiversity assessments. The present study supported the vertical flow of spatially-distributed information driven by GIS. Data can be aggregated and generalized to produce information about gaps and reserves that could suit a wide variety of users including policy makers, researchers, donor-funded projects. If the quality of land-use planning and decisions can be improved by incorporating a better understanding of the location of the important elements of diversity, and of our effects upon them, sustainable development of our biosphere may succeed (Davis *et al*, 1990).

Acknowledgments

The author would like to thank Miss Akela Ahined Chazawi and Mr. Mohammed Awad for the help in GIS overlays and typing; Dr. Robyn Usher for reviewing drafts of this paper, and Prof. M. Ayyad for scientific advises and consultations.

and communities in every phytogeographic zone, (b) many more protected areas (better protected), and (c) restoration of degraded ecosystems.

The past few decades have witnessed tremendous advances in information technology and efforts to harness the power of these technologies on behalf of biodiversity conservation. GIS technology comes on the top of these technologies that favored the biodiversity conservation applications. The case study presented here demonstrates that using the technicalities of GIS, existing information can be input, managed and analyzed, and needs for additional information can be identified. The present study also directs a message to the GIS community for the need of their skills to address the biodiversity problems, and the use of GIS as a tool for managing biodiversity databases to achieve a national biodiversity data system based on GIS approaches. This system would serve for sustainable management of the natural resources which is a major component of any biodiversity strategy.

The present study used the threatened arboreal species and their spatial distribution in Egypt in a surrogacy approach. Areas that are rich in diversity of these species are assumed to be rich in general. The locations of threatened arboreal species were plotted on the base map of Egypt using "points" to represent their range. These could have been an alternative, however Synthetic methods generalize data to units that are not ecological relevant, and the location precision is lost in the process of generalization. This conclusion is in accordance with that by Davis et al, (1990).

The ACVs and CCVs of threatened arboreal species in each of the protected areas proved to be an appropriate methodology for assessing ranking and ordering of protected areas in terms of their contribution to the conservation of biodiversity of these species. The results presented in Table4 shows that the first order category of ranking is composed of three of the already declared protected areas, and that, in the same mean, these areas are three of the 34 internationally important bird areas in Egypt. This finding provides evidence that arboreal species can be considered as "indicator taxa" and that these taxa are associated with other important communities. It also ensures the wise conservation actions taken by the national environmental agencies in conserving the biodiversity of important ecological regions, e.g., "Elba" and "Sinai".

The same composite information of threatened arboreal species ACV, and internationally important bird areas are used to highlight the significant areas for conservation. According to this information, three of the proposed protected areas, namely "S allum", "Great Red Sea Reef' and "Gebel Maghara" should be given a high priority for establishment than the others short- term basis.

The gap analysis conducted in the present study identifies gaps in the network of protected areas, and provides baseline information that can be used for monitoring, assessing and managing the biodiversity conservation of protected areas. This is evident from overlay 3 which demonstrates clearly that some of the proposed protected areas need further studies and analysis to

the locations occupied by the threatened arboreal species. However there are some gaps in the network of protected areas that need to be filled to ensure the conservation of these species, namely northern and eastern Sinai (the Isthemic desert phytogeographic subdivision) and the Nubian Nile subdivision. It is also clear that some of the proposed protected areas need to be repositioned to fit the location of some of the threatened arboreal species such as Um El Ghuzlan (P6), El Qasr (P7), El Galala (P11) and Quseima (P17).

Overlay 4: The map of distribution of arboreal species and the network of protected areas overlaid on map of locations of internationally important bird areas Figure (7). It is obvious that about 15 of the 34 important bird areas coincide with the areas of high diversity of threatened arboreal species e.g. Gebel Elba (4 areas), South Sinai (6 areas). This calls for considering the establishment of bird watching facilities in the management plans of these protected areas to encourage ecotourism. Besides, some of the proposed protected areas include locations of important bird areas, e.g. El Qasr (P7), The great Red Sea reefs (P16) and Qusiema (P17).

DISCUSSION

Conversion of natural habitats by man is the major cause of the loss of biological diversity that needs to be surveyed, mapped, monitored and quantified. No survey or monitoring of biodiversity is complete without considering how efforts are being deployed, and how the emerging information will be organized and compiled in databases. This effort has to be associated with coordination of information that already exists for better usage in a complementary manner to highlight subtle relationships between biota and associated environmental features. The biodiversity convention makes clear that access to good information about biological diversity is key to mobilizing resources in support of conservation and sustainable use of these biological resources. Biodiversity conservation efforts in particular are in need of being informed about where and what species and ecosystems should be targeted for protection, where do they occur, and how we should protect and manage these resources, and the areas that sustain them, for the benefit of present and future generations. Generally, Protected areas contribute to conserving biodiversity. However, few protected areas have yet to be given full attention to the biodiversity issue. Many national parks, for example, have been declared primarily for their scenic values, tourism and recreation (McNeely, 1994). Therefore all countries should review their protected area systems and identify additional sites of critical importance for conservation of biological diversity.

Natural environments in Egypt are assailed on every side through the unprecedented and rapid expansion of human activities. In the absence of conservation responses of a scope and scale matching these activities, the country will shortly witness environmental degradation and destruction of many of the fragile habitats and their biotas. Fortunately, we still have time, to slow down the degradation process and the loss of biodiversity. This could be achieved by (a) initiatives directed at sustainable development of all habitats

biodiversity of threatened arboreal species. Accordingly, the protected areas could be ranked to 18 levels. These ranks were distinguished into 5 categories from the highest to the lowest ranking. The first order category is attained by three of the already declared protectorates. It is remarkable that some of the proposed protected areas attain higher relative rankings, than some of the already declared protected areas. Thus the second order category comprise five rankings, 3 of which are attained by proposed protected areas, with relative ranking of 4, 5 and 6, while the third order category comprises 6 rankings, 5 of which are attained by proposed protected areas.

It is worth mentioning that, there are 13 of the analyzed protected areas do not contribute to the conservation of the biodiversity of threatened arboreal species, either because they are marine or do not contain any of the threatened arboreal species in their vegetation composition.

The overlay analysis in the present study, (Table 3), starts with five main coverages: (1) the base map of Egypt; (2) location map of the 101 threatened arboreal species; (3) location map of phytogeographical subdivisions (Figure 2); (4) location map of protected areas (declared and proposed) (Figure 3), and (5) location map of internationally important bird areas. Four overlays were carried out to highlight the relations imbedded in the data. Each of these overlays will be discussed and interpreted separately.

Overlay 1: Maps of the threatened arboreal species (101 species) overlaid onto the base map of Egypt. (Figure 4) The resulting map illustrates the distribution of these species in Egypt, while the species names, commonness, species richness, ecological (life form) and economic (number of uses) importances are associated to the map as attribute data. This map is used to define the regions in Egypt occupied by the greatest number of different threatened arboreal species. It is obvious that certain small areas are occupied by relatively large numbers of threatened arboreal species (high diversity), e.g. Gebel Elba (> 40 species), and south Sinai (> 20 species). Other larger areas are occupied by smaller numbers of segregate arboreal species (low diversity) e.g. north Mediterranean (4 species), and the south-western borders of Egypt (one species only). The following overlay was applied to add precision to the above results.

Overlay 2: Map of the phytogeographical subdivisions overlaid on the above map of the distribution of threatened arboreal species, (Figure 5): in order to classify these subdivisions according to their species richness. It is clear that the Sahelian Scrub (Sa) was the richest phytogeographical subdivision, with about 46 arboreal threatened species followed by the Isthemic Desert phyto geo graphic subdivision (Di) with about 15 species. This is in contrast with the Arabian Desert (Da) with three threatened arboreal species, El Uweinat subdivision with only one species, and the Nubian Desert (Dn) subdivision with no threatened arboreal species.

Overlay 3: Gap analysis. The map of protected areas in Egypt Figure (3) overlaid onto the map of distribution of threatened arboreal species Figure (6). This Figure demonstrates generally that the protected areas cover most of

Table (3): Ranking of protected areas (declared and proposed) according to cumulative conservation value (CCV) of threatened arboreal species.

Protectorate Name	Declared (D)/ Proposed (P)	Cumulative Conservation Value (CCV)		
		Value	**Relative Rank**	**Orders**
1. *Elba	D	189.00	1	
2. *St. Catherine	D	94.75	2	1^{st} (1-3)
3. *Taba	D	33.25	3	
4.-Salluga & Ghazal	D	17.75	4	
-Salum	P	17.75	4	
5. *Great Red Sea Reef	P	16.50	5	2^{nd} (4-7)
6. *Gebel Maghara	P	15.25	6	
7. *Zaranik	D	15.00	7	
8. –Omayed	D	10.75	8	
-El-Galala	P	10.75	8	
9. –Um l-Ghuzlan	P	9.75	9	3^{rd} (8-10)
-Sabkhat Ras Shukeir	P	9.75	9	
-*Quseima	P	9.75	9	
10. Showela	P	9.00	10	
11. Qattara	P	6.75	11	
12. –Al-Ahrash	D	6.5	12	
-Ras El-Hekma	P	6.5	12	
13. Hamata	P	6.25	13	
14 -Sanur Cave	D	5.75	14	4^{th} (>10)
-Gilf Kebir	P	5.75	14	
15. *El-Qasr	P	5.25	15	
16. -*Nabq	D	5.00	16	
-Abu-Ghallum	D	5.00	16	
-El-Shayed	P	5.00	16	
17. –El-Hasna	D	4.5	17	
-Wadi Allaqui	D	4.5	17	
18. *Lake Quarun	D	3.75	18	
19. Karkur & Dungul	P			
20. White desert	P			
21. Wadi Qena	P			
22. Girafi	P			
23. Um-Dabadib	P			
24. *Ras Mohammed	D			
25. Ashtoum El-Gamil	D			No Contrib.
26. Pet. Forest	D			
27. *Wadi Rayan	D			
28. *El-Burullus	D			
29. Nile islands	D			
30. Wadi Assuti	D			
31. Wadi Degla	D			

* Internationally Important Bird Areas.

Table 3 summarizes the CCV's and provides relative ranking of the 40 protected areas according to their contribution to the conservation of

indicate the contribution of each protected area to the conservation of biodiversity of threatened arboreal species. If information on other plant life-forms are similarly treated and their CCV are added to the above values, an average value for each protected area could be calculated as an assessment of its conservation index (C I). From the same Figure, it is clear that "Elba" protected area attain the highest CCV and thus contributes highly to the conservation of the biodiversity of threatened arboreal species. This is followed by "St.Catherine" and "Taba" protectorate 5. Similarly, from Figure 1.b, "S allum" proposed protected area attain the highest CCV, and thus can contribute highly to the conservation of biodiversity of threatened arboreal species. This is followed by "Great Red Sea Reef" and "Gebel Maghara" proposed protected areas.

Table (2):

Over -lay No.	Overlay Desceription	Indication
1	All maps of species distribution onto the map of Egypt	Range and distribution of the 101 endangered species (names identified in the associated database).
2	Overlay 1 onto the phytogeographical subdivisions and the map of protected areas (declared and proposed).	Distribution of threatened arboreal species in each phytogeographical subdivision How well protected areas are representing the PhvtogeogaPhical subdivisions.
3	Overlay 1 onto maps of protected areas (declared and `,roposed).	This is a representation of the gap analysis that identifies the areas in need of conservation
4	Overlay 1 onto the map of distribution of important bird areas and map of protected areas (declared and proposed).	Assessing the relationship between the distribution of arboreal species as indicator taxa and important bird areas. Assessing the overlap between protected areas (declared and proposed) and important bird areas.

RESULTS

Data on spatial and aspatial affribute described in the above section constitute a nucleus of a GIS-based biodiversity database that is assembled for the first time. The results of the study are presented as maps and tables. The list of species and the scores assigned to each according to the criteria described in Table1 are provided in Appendix 1.

The ACVs and CCVs described in the previous section were ploffed for the declared and proposed protected areas in Figures 1 a and lb respectively, and ranked as a function of the cumulative conservation values (C CV) in Table 3.

Figure 1.a illustrates the scale of conservation value (0-10) on the Y-axis versus the declared protected areas (21) (X-axis). The bars in the Figure indicate the range of Average Conservation Value (ACV) of arboreal species in each particular protected area, while the numbers between brackets on the bars indicate the number of species that attain this particular ACV. The numbers in circles on the X-axis indicate the Cumulative Conservation Value (CCV) for all species that exist in any particular protected area. Protected areas with no corresponding CCV are either not applicable (marine areas), or do not include any of the threatened arboreal species. The CCVs are used to

6. A map of protected areas of Egypt produced by the Nature Conservation sector - the Egyptian Environmental Affairs Agency (EEAA).

7. Spatial distribution of important bird areas in Egypt as recognized by Baha El- Din, (1999).

All the above data were sorted according to their type as spatial or aspatial The spatial data were digitized, edited and made usable as GIS data layers using PC-Arc/Info and ArcView GIS sofiware packages produced by ESRI (Environmental Systems Research Institute). The aspatial data were associated within the spatial database as appropriate. The species names were revised using the checklist published by Boulous 1995.

The aspatial data on threatened arboreal species; degree of threat and ecological and economic value were assembled in the database for every species, and were used to calculate a conservation value "CV" for each species. This value was obtained according to a scoring system on a graduated scale of 10 identified by the criteria listed in Table 1. The conservation value "CV" for each species, as a function of the 4 criteria (each out of 10) were added to yield a value out of 40 which was then divided by 4 to produce an average conservation value (ACV) out of 10 for each of the 101 plant species listed in the database.

Table(1):

1. Status	Extinct	10
	Endangered	7
	Intermediate (Endangered/Vulnerable)	5
	Vulnerable	4
2. Commonness	Endemic	10
	Very rare	7
	Rare	4
	Common	2
3. Life form (ecological importance)	Tree	10
	Intermediate (small tree or large shrubs)	8
	Shrubs	7
	Woody herb	4
	Perennial herb	2
4. Uses (economic importance)	More than three uses	10
	Three uses	8
	Two uses	6
	One use other than above	4
	Single use (wood production)	2

The average conservation values (ACV) for all arboreal species occurring spatially inside the boundaries of any particular protected area were summed to produce a cumulative conservation value (CCV) for each protected area. This value is an index of its contribution to the conservation of biodiversity of threatened arboreal species in Egypt.

Several overlay analyses were applied to the data of the present study. These are indicated in Table(2):

species can be considered as indicator taxa that incorporate other vegetation communities and animal species (specially birds). Therefore the present study examines, using GIS, the relation of the distribution of arboreal species with other existing spatial data e.g. phytogeographical subdivision and international important bird areas in Egypt. Generally, arboreal species represent a part of the wealth of Egyptian flora that is threatened and endangered with different degrees, and calls for conservation actions to be taken.

The objectives of the present study are: (1) establishing a digital database of endangered arboreal species including their spatial distribution, ecological importance, degree of threat, commonness and economic importance; (2) analyzing the relative contribution of each protected area in terms of contribution to conserve the biodiversity of threatened arboreal species in Egypt; (3) conducting gap analysis which identifies hot spots and gaps in the network of protected areas (declared and proposed) for formulating sound biodiversity conservation management strategies; and (4) assessing the relation between the distribution of arboreal species, phytogeographical subdivision and international important bird areas in Egypt by integrating these data in a common GIS based system.

DATA ACQUISITION AND TREATMENT

The present study demonstrates a compilation of existing data in a GIS-based approach to allow organization, synthesis, and spatial analysis of these data using different overlays (the asset of GIS analysis) to improve the assessment and monitoring of biodiversity. The following is a list of the core data used and analyzed, to establish a nucleus of a biodiversity database management system based on GIS:

1. A base map of Egypt of appropriate scale.

2. Data extracted from Egyptian Plant Red Data book (trees and shrub) by El-Hadidi *et al.*, 1992. These data form a list of 101 arboreal threatened species, their distribution, ecological importance and degree of threat. A point indicating the location of each species in the above list was ploffed on the base map of Egypt, and other data were affached to the map as affribute data. These data describe the degree of threat, commonness, life form (ecological importance), and uses (economic importance). These data sources are indicated below.

3. Data extracted from the Multipurpose Species in Arab African Countries (Ayyad, 1998) on economic importance of arboreal species in Egypt in terms of its number of uses.

4. A map of the phytogeographical subdivision in Egypt as described by Boulous 1995.

5. A list of endemic species in each phyto geo graphic subdivisions as listed by Boulous 1995.

species that are not adequately represented in an existing protective network of biological diversity (Spellerberg *et al.*, 1999). Gap analysis helps to locate priority areas for conservation action and research. The technique can therefore be used as a means to prioritize human effort in habitat protection and management in order to achieve the conservation of a region's biological diversity (Scoff et al, 1996). The principle application of gap analysis is to describe spatially, in any particular region, where are the priority areas for habitat protection to conserve species and animal communities that are not already protected. It is considered to be a rapid method for evaluating conservation requirements for protection of biological diversity. In North America, gap analysis has been used to identify shortfalls in conservation programmes to protect biological diversity (Spellerberg, *et al.* 1999). Gap analysis projects have several applications, including the following: they can be used to determine the representation of species and natural plant and animal communities within areas being managed for biodiversity conservation, they provide data to model wildlife habitat distributions, and they provide a baseline of information about the distributions of plant and animal species and communities that can be used for comparative analysis of future changes in those distributions (that is, monitoring environmental change).

Distributions of a range of species are modeled with GIS using maps of vegetation types and observations on the distributions of species of interest. These distributions are combined within the GIS to identify areas of greatest diversity or core areas for different species. The composite information could then be compared with the distribution of protected areas to highlight significant areas that need conservation. An ideal set of data for assessing the status of biodiversity includes the distribution of species and its conservation status, the habitat characteristics of these species, human activities on these habitats and their impact. Also some data on the ecological and economic value of species required. These data can be stored on a map (distribution) associated with tabular data for showing aifributes. Davis et al, (1990) described, in concept, a comprehensive national diversity information system, using geographic information system (GIS) techniques to organize existing data and improve the spatial aspects of the assessment. In this study, Davis et al, quoted that a potential GIS analysis is to ideate gaps in the network of California nature reserves, and concluded that available data can be used more effectively and before management strategies can be formulated.

The present case study is an illustration of the above concepts. It presents a specific component of a conservation program; the distribution of a range of plant species (arboreal) associated with affribute data describing the ecological and economic importance of each species, its life form and degree of threat. These data are modeled in a GIS-based database and overlaid on spatial data of the protected areas (declared and proposed) in Egypt, to identifv significant areas that require conservation. The data of arboreal species used in the present study are the threatened species of trees and slrrubs in Egypt as recognized by El-Hadidi *et al.*, (1992). They were selected as they constitute the main framework of the ecosystems in which they occur and therefore acquire high ecological significance to these ecosystems. Arboreal

APPLICATION OF GIS FOR BIODIVERSITY MONITORING In Egypt

Dr. Boshra B. Salem

Assistant Professor- Dept. of Environmental Sciences,
Faculty of Science, Alexandria University

ABSTRACT

Recently, there has been a revolution in the availability of information and in the development and application of tools for managing information. Information needs for biodiversity are many and various. The database that deals with biodiversity information has to be geographically based, and able to predict where new populations of endangered species with a limited known range might be expected, indicating potential hot spots. An important tool for monitoring biodiversity is Geographic Information Systems (GIS), which accommodate large varieties of spatial and aspatial (aitribute) data. The information embedded in a GIS is used to target surveys and monitoring schemes. Data on species and habitat distribution from different dates allow monitoring of the location and the extent of change. This paper discusses issues related to: (1) the need for biodiversity information and databases; (2) the importance of national information strategies; and (3) the application of GIS as a tool in monitoring biodiversity; and (4) a case study of a GIS-based approach, applied to endangered arboreal species in Egypt. It applies the overlay analysis of maps of endangered plant species ranges onto the maps of protected areas (declared and proposed).

The output is threefold: (1) a complete database of endangered arboreal species as they are listed in the Egyptian Plant Red Data Book and their spatial distribution; (2) a relative contribution index of each of the protected area (proposed and declared) in the conservation of biodiversity of threatened arboreal species in Egypt; (3) a gap analysis that identifies the areas in need of conservation and(4) an illustration of the relation between location of arboreal species and location of international important bird areas in Egypt.

Keywords: Biodiversity, Conservation, Protected areas, Databases, Geographic Information System (GIS), Endangered species, Gap analysis, Hot spots.

INTRODUCTION

Data showing species and habitat distribution or sometimes models that predict these distributions are used to analyze the effectiveness of existing conservation areas. The gap analysis system developed in the USA uses GIS to identify significant areas of habitat and parts of the geographic range of a species that are not protected by any form of conservation designation (Scoff *et al.* 1993). Gap analysis is a technique for identifying vegetation types and

Table (5): :Species list of some insects in Shayeb El-Banat mountain group and coastal areas.

Dericorys albidula, Dermestes sp., Eremica desertorum, Haemphysalis sulcata, Hyalomma anatolicum, Hyalomma dromedarii, Ocnera sp., Ornithodoros foleyi, Pompilus vespiformis and *Potomonectes sp.*

Table (6): List of the common coral reef species in the marine area around Hurghada.

Acropora corymbosa, Acropora cytherea, Acropora eurystoma, Acropora haimei, Acropora humilis, Acropora hyacinthus, Acropora nobilis, Acropora valenciennesi, Cyphastrea microphthalma, Cyphastrea serailia, Echinopora gemmacea, Favia favus, Favia pallida, Favia stelligera, Favites flexousa, Galaxea fascicularis, Goniastrea pectinata, Goniastrea retiformis, Goniopora planulata, Hydnophora microconus, Lobophyllia corymbosa, Millepora dichotoma, Montipora meanderina, Montipora monasteriata, Montipora verrucosa, Oxypora lacera, Platygyra lamellina, Pocillopora damicornis, Pocillopora verrucosa, Porites compressa, Porites lutea, Porites solida, Seriatopora hystrix, Stylophora pistillata and *Turbinaria mesenterina.*

Trigonella stellata	Fabaceae
Typha domingensis	Typhaceae
Zilla spinosa	Brassicaceae
Ziziphus spina-christi	Rhamnaceae
Zygophyllum album	Zygophyllaceae
Zygophyllum coccineum	Zygophyllaceae
Zygophyllum simplex	Zygophyllaceae

Table(2): Species list of birds in Shayeb El-Banat mountain group and coastal areas.
R = Resident, P= Passer and V= Visitor]

Acrocephalus scirpaceus fusca) R/V ,(*Actitis hypoteucos*) P/V ,(*Alaemon alaudipes desertorum*) R ,(*Ammomanes deserti deserti*) R ,(*Anthus spinoletta coutellii* (V/P), *Apus melba melba* (P/V), *Bubo bubo ascalaphus* (R), *Buchinus oedicnemus oedicnemus* (R/V), *Calandrella crinerea hermonesis* (P/V/R), *Calidris alba* (P/V), *Charadrius leschenaultii* (P/V/R), *Chettusia gregaria* (P/V), *Chlidonias niger niger* (P/V), *Coraciac garrulus garrulus* (P), *Corvus ruficollis ruficollis* (R), *Corvus splendens splendens* (R), *Cuculus canorus canorus* (P), *Dormas ardeola* (V), *Eremopterix nigriceps melanauchen* (R), *Haematopus ostralegus* (P/V), *Hippolais olivetorum* (P), *Lanius excubitor elegans* (R), *Lanius senator senator* (P), *Larus canus canus* (V), *Larus ichthyaetus* (P/V), *Limosa lapponica lapponica* (P/V), *Melanocorypha bimaculata rufescens* (P), *Oceanites oceanicus oceanicus* (P), *Oenanthe oenanthe* (P/V), *Phylloscopus collybita abietina* (P), *Prinia gracilis* (R), *Sterna albifrons albifrons* (R), *Sterna hirundo hirundo* (P/V), *Sterna respressa* (R), *Sterna saundersi* (V), *Sylvia melanocephala melanothorox* (V), *Tringa erythropus* (P/V), and *Tringa glareola* (P/V).

Table (3): Species list of mammals in Shayeb El-Banat mountain group and coastal areas.

Acopys cahirinus, Ammotragus lervia, Camelus dromedarius, Canis aureus, Capra hircus, Capra ibex, Caracal caracal, Dipodillus henleyi, Felis margarita, Gazella dorcas, Gerbillus gerbillus, Hyaena hyaena, Jaculus jaculus, Lepus capensis, Meriones crassus, Ovis longipes, Panthera pardus, Rhinopoma sp., Sekeetamys calurus and *Vulpes rueppelli.*

Table(4): Species list of reptiles in Shayeb El-Banat mountain group and coastal areas.

Acanthodactylus boskianus asper, Agama agama spinosa, Chamaeleon chamaeleon, Coluber rhodorharchis rhodorharchis, Coretta coretta, Crytopodion crytopodion scaber, Dermochelys coriacea, Echis coloratus, Eretmochelys imbricata, Hemidactylus flaviviridis, Hemidactylus turcicus, Hemidactylus turcicus, Lytorhynchus diadema, Pseudotrapelus siniatus, Spenops sepsoides, Telescopus dhara obtusus, Tropiocolotes steudneri, Uromastyx acanthinurus, Uromastyx ocellatus ocellatus and *Varanus griseus griseus.*

Plantago ovata	Plantaginceae
Poa sinaica	Poaceae
Podonosma galalensis	Boraginaceae
Polycarpaea repens	Caryophyllaceae
Polypogon monspeliensis	Polygonaceae
Polypogon monspeliensis	Poaceae
Pteranthus dichotomus	Caryophyllacea
Pulicaria crispa	Asteraceae
Pulicaria undulata	Asteraceae
Reaumuria hirtella	Tamaricaceae
Reichardia tingitana	Asteraceae
Reseda pruinosa	Resedaceae
Retam raetam	Fabaceae
Rhamnus dispermus	Rhamnaceae
Rhamnus sp	Rhamnaceae
Rhus tripartita	Anacardiaceae
Robbairea delileana	Caryophyllacea
Rumex vesicarius	Polygonaceae
Salsola baryosoma	Chenopodiaceae
Salsola paryosoma	Chenopodiaceae
Salsola schweinfurthii	Chenopodiaceae
Salsola vermiculata	Chenopodiceae
Salvadora persica	Salvadoraceae
Salvia aegyptiaca	Lamiaceae
Samolus valerandi	Primulaceae
Schouwia thebaica	Brassicaceae
Scorzonera schweinfurthii	Asteraceae
Scrophularia deserti	Scrophulariaceae
Seidletzia rosmarinus	Chenopodiaceae
Senecio flavus	Asteraceae
Senna italica	Fabaceae
Silene linearis	Caryophyllaceae
Sisymbrium irio	Asteraceae
Solenostemma arghel	Asclepiadaceae
Stachys aegyptiaca	Lamiaceae
Stipagrostis plumosa	Poaceae
Suaeda monoica	Chenopodiceae
Tamarix amplexicaulis	Tamaricaceae
Tamarix aphylla	Tamaricaceae
Tamarix nilotica	Tamaricaceae
Taverniera aegyptiaca	Fabaceae
Telephium sphaerospermum	Caryophyllacea
Tephrosia apollinea	Fabaceae
Teucrium leucocladum	Lamiaceae
Thymus bovei	Lamiaceae
Tribulus sp	Zygophyllaceae
Trichodesma africana	Boraginaceae

Helianthemum lippi	Cistaceae
Heliotropium arbainense	Boraginaceae
Hyoscyamus boveanus	Solanaceae
Hyoscyamus desertorum	Solanaceae
Ifloga spicata	Asteraceae
Imperata cylidrica	Poaceae
Iphiona mucronata	Asteraceae
Isatis microcarpa	Brassicaceae
Juncus rigidus	Juncaceae
Kickxia aegyptiaca	Scrophulariaceae
Kohautia caespitosa	Rubiaceae
Lasiurus hirsutus	Poaceae
Launaea cassiniana	Asteraceae
Launaea nudicaulis	Asteraceae
Launaea spinosa	Asteraceae
Lavandula pubescens	Lamiaceae
Lavandula stricta	Lamiaceae
Leptadinia pyrotechnica	Ascelpiadaceae
Lindenbergia indica	Scrophulariaceae
Lindenbergia sinaica	Scrophulariaceae
Lotononis platycarpa	Fabaceae
Lotus deserti	Fabaceae
Lycium shawii	Solanceae
Maerua crassifolia	Capparaceae
Matthiola livida	Brassicaceae
Monsonia heliotropoides	Geraniaceae
Morettia philaena	Asteraceae
Moringa peregrina	Moringaceae
Nepeta persica	Lamiaceae
Neurada procumbens	Neuradaceae
Nitraria retusa	Nitrariaceae
Noaea mucronata	Chenopodiaceae
Ochradenus baccatus	Resedaceae
Olea europaea subsp africana	Oleaceae
Oryzopsis miliaceum	Poaceae
Oxystelma alpinii	Asclepiadaceae
Panicum turgidum	Poaceae
Paritaria alsinifolia	Urticaceae
Paronychia arabica	Caryophyllacea
Paronychia arabica	Caryophyllacea
Peganum harmala	Zygophyllaceae
Pergularia tomentosa	Asclepiadaceae
Periploca aphylla	Asclepiadaceae
Phagnalon barbeyanum	Asteraceae
Phragmites australis	Poaceae
Pistacia khinjuk	Anacardiaceae
Pituranthos tortuosus	Apiaceae

Centaurea scoparia	Asteraceae
Chrozophora oblongifolia	Euphorbiaceae
Cistanche phelypaea	Orobanchaceae
Citrullus colocynthis	Cucurbitaceae
Cleome amblyocarpa	Cleomaceae
Cleome arabica	Cleomaceae
Cleome chrysantha	Cleomaceae
Cleome droserifolia	Cleomaceae
Cocculus pendulus	Menispermaceae
Colchicum guessfeldtianum	Liliaceae
Cometes abyssinica	Caryophyllaceae
Convolvulus hystrix	Convolvulaceae
Conyza bovei	Asteraceae
Cornulaca monacantha	Chenopodiaceae
Cotula cinerea	Asteraceae
Crotalaria aegyptiaca	Fabaceae
Cucumis prophetarum	Cucurbitaceae
Cynodon dactylon	Poaceae
Cynomorium coccineum	Cynomoriaceae
Diplotaxis acris	Brassicaceae
Diplotaxis harra	Brassicaceae
Echinops glaberrimus	Asteraceae
Echinops spinosus	Asteraceae
Ephedra alata	Ephedraceae
Ephedra aphylla	Ephedraceae
Erodium glaucophyllum	Geraniaceae
Erodium glaucophyllum	Geraniaceae
Erodium hirtum	Geraniaceae
Erodium pulverulentum	Geraniaceae
Erucaria pinnata	Brassicaceae
Euphorbia granualata	Euphorbiceae
Fagonia bruguieri	Zygophyllaceae
Fagonia mollis	Zygophyllaceae
Fagonia thebaica	Zygophyllaceae
Fagonia tristis	Zygophyllaceae
Farsetia aegyptia	Brassicaceae
Farsetia ramosissima	Brassicaceae
Ficus palmata	Moraceae
Filago prolifera	Asteraceae
Forsskaolea tenacissima	Urticaceae
Gnaphalium luteo-album	Asteraceae
Gymnocarpos decandrum	Caryophyllacea
Halogeton alopecuroides	Chenopodiaceae
Halogeton alopecuroides	Chenopodiceae
Haloxylon persicum	Chenopodiceae
Haloxylon salicornicum	Chenopodiaceae
Helianthemum kahiricum	Cistaceae

Appendix Tables

Table(1): Plant species list of Shayeb El- Banat mountain group and the coastal areas.

Plant species	Family
Acacia albida	Fabaceae
Acacia ehrenbergiana	Fabaceae
Acacia tortilis subsp raddiana	Fabaceae
Achillea fragrantissima	Asteraceae
Adiantum capillus-veneris	Adiantaceae
Aeluropus littoralis	Poaceae
Aeluropus massuaensis	Poaceae
Aerva javanica	Amaranthaceae
Alhagi graecorum	Fabaceae
Althaea ludwigii	Malvaceae
Anabasis articulata	Chenopodiaceae
Anabasis setifera	Chenopodiaceae
Anastatica hierochuntica	Brassicaceae
Anchusa milleri	Boraginaceae
Andrachne aspera	Euphorbiaceae
Anticharis glandulosa	Scrophulariaceae
Arnebia hispidissima	Boraginaceae
Artemisia herba-alba	Asteraceae
Artemisia judaica	Asteraceae
Ascelpias sinaica	Asclepiadaceae
Asphodelus fistulosus	Liliaceae
Astragalus crucicatus	Fabaceae
Astragalus eremophilus	Fabaceae
Astragalus sieberi	Fabaceae
Astragalus spinosus	Fabaceae
Astragalus vogelli	Fabaceae
Atriplex dimorphstegia	Chenopodiaceae
Atriplex inamoena	Chenopodiaceae
Atriplex leucoclada	Chenopodiaceae
Avicennia marina	Avicenniaceae
Balanites aegyptiaca	Balanitaceae
Bassia eriophora	Chenopdiceae
Blepharis ciliaris	Acanthaceae
Bromus fasciculatus	Poaceae
Calligonum comosum	Polygonaceae
Calotropis procera	Asclepiadaceae
Capparis sinaica	Capparidaceae
Capparis decidua	Capparidaceae
Capparis spinosa	Capparidaceae
Caylusea hexagyna	Resedaceae
Centaurea eryngoides	Asteraceae

Hassib, M. (1951). Distribution of plant communities in Egypt. Bulletin of Faculty of Science, Fouad I University (Cairo), 29: 59-261.

Hegazy, A.K., El-Demerdash, M.A. & Hosni, H.A. (1998). Vegetation, species diversity and floristic relations along an altitudinal gradient in south-west Saudi Arabia. *Journal of Arid Environments*, 38: 3-13.

Hegazy, A. K. & Fahmy, A. G. (2000). Baseline study for nomination of Shayeb El-Banat Mountain group as UNESCO biosphere reserve. Technical report, UNESCO Cairo office. 32 p + 9 colour plates.

Hegazy, A. K. & Amer, W. M. (2001). Altitudinal and Latitudinal Diversity of the Flora on the Eastern and Western Sides of the Red Sea. Presented in this symposium.

Hobbs, J.J. (1990). *Bedouin Life in the Egyptian Wilderness*. Cairo: The American University in Cairo Press. 165 p.

Hodgson, E.S. (1983). Coral reef community structure at Al-Ghardaqa, Red Sea .*Bulletin of the National Institute of Oceanography and Fisheries*, 9: 116-123.

IUCN (1984). National Parks, Conservation and Development: the Role of Protected Areas in Sustaining Society. USA: Smithonian Institution Press.

Kassas, M. & Girgis, W.A. (1969/197). Plant life in the Nubian desert east of the Nile, Egypt .*Bulletin de l'Institut d'Egypte*, 2:47-71.

Kassas, M. & Zahran, M.A. (1967). On the ecology of the Red Sea littoral salt marsh, Egypt .*Ecological Monographs*, 37: 297-316.

Kassas, M. & Zahran, M.A. (1971). Plant life on the coastal mountains of the Red Sea, Egypt. *Journal of Indian Botanical Society*, 50 A: 571-589.

Nature Conservation Sector (NCS). (1998). *Towards Establishing a Network Plan for Protected Areas in Egypt*. A Consultative document, compiled by S. M. Baha El-Din. Egyptian Environmental Affairs Agency (EEAA). 140 p.

Täckholm, V. (1974). *Students Flora of Egypt*. Cairo: Cairo University. 888 p.

UNEP / IUCN (1988 .(*Coral Reefs of the World*, Vol. 2: Introduction and Coral Reef of Egypt. pp. 57-73.

Wood, E.M. (1983 .(*Corals of the World*. TFH Publications Inc., Ltd.

Zahran, M.A. & Willis, A.J. (1992). *The Vegetation of Egypt*. London: Chapman & Hall. 424 p.

Tourism and non-consumptive recreation can be consistent with the objectives of protection. Excessive visitation and use of the resources in the reserve by tourists, can damage the sensitive sites. Thus, restrictions on certain uses, and on overuse, must be part of the management plan. Tourism based activities should concentrate on appreciation of the natural settings and the intrinsic value of the reserve.

RECOMMENDATIONS

(1) The necessary steps should be taken to: (a (Urge the Egyptian authorities declare the area as protected area, appoint the management staff and fulfill the requirements of MAB programme; and (b) Establish the area as biosphere reserve.

(2) Concerned authorities assign an expert team to develop plans for research, monitoring, training, education and sustainable development of the biosphere reserve.

(3) Studies needed include: (a) Detailed ecological baseline survey to cover the biota (flora and fauna), landscape and seascape survey, ecosystem dynamics, complete hydrological survey and socio-economic studies; (b) Biotic and abiotic assessment of the area to help clear demarcation of the biosphere core, buffer and transitional zones; and (c) Production of thematic maps.

Acknowledgment.

This study was achieved based on Activity-Financing Contract (Ref. 831819-9) between UNESCO Cairo Office and Dr Ahmad K. Hegazy (Professor of Conservation and Applied Ecology, Department of Botany, Faculty of Science, Cairo University, Giza 12613, Egypt). We thank Dr M. El-Deek, Director, UNESCO Cairo Office for kind support and encouragement to achieve this task.

BIBLIOGRAPHY

Abdel-Salam, H.A. (1993). Impacts of landfilling on coral reef ecosystem of south magawish, Herghada, Red Sea .*Journal of Egyptian German Society of Zoology*, 11 D: 187-198.

Abu Al-Izz, M.S. (197) *Landforms of Egypt*. Cairo: American University in Cairo Press. 281 p.

Ali, A.A.M. (1984). *Population Studies Among Shallow Reef Corals of Al-Ghardaqa (Hurghada), Red Sea*. M. Sc. Thesis, Faculty of Science, Cairo University. 116 p.

Baha El-Din, S.M. (1999). Directory of Important Bird Areas in Egypt. Cairo: Palm Press. 113p.

Boulos, L. (1995). *Flora of Egypt Checklist*. Cairo: Al Hadara Publishing. 284 p.

knowledge.

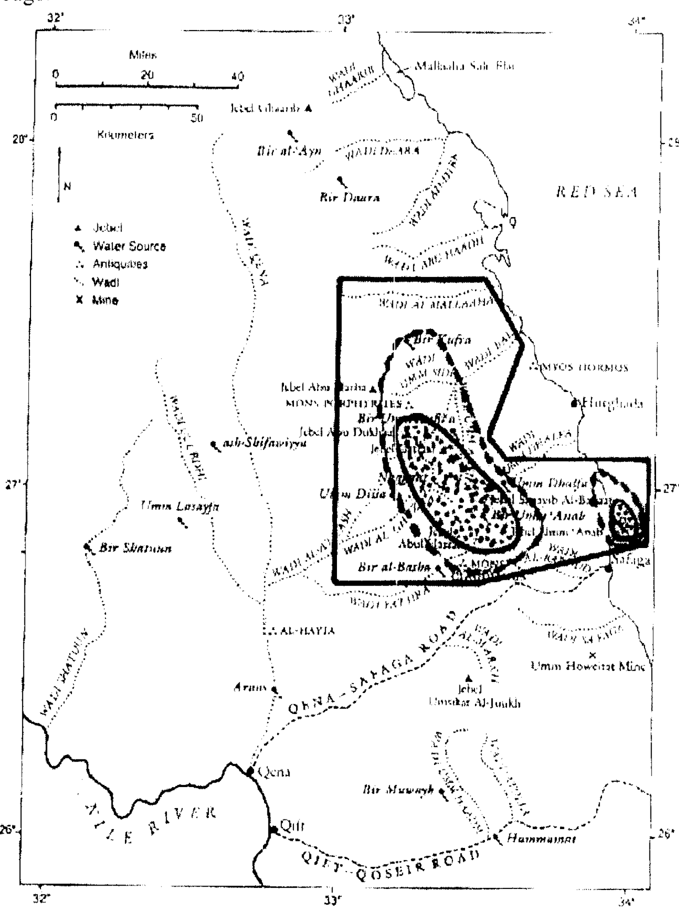


Figure 2: Suggested location of the biosphere reserve and its zones. A = Core zone, B = Buffer zone, and C = Transitional zone.

Not enough is known about the interactions among plant and animal species, or the ecology of the area and its surroundings. Ecosystem management requires both natural and social science research to develop the understanding needed to manage ecological and human relationships and interactions. Comprehensive studies at different levels of organizations (individuals, populations, communities, ecosystems and landscape / seascape) are needed. Systematic coordinated field studies along environmental and anthropogenic gradients can provide important and very much needed information for conservation and sustainable use of the reserve.

4- Assessment and monitoring of short-term and long-term conservation and restoration programmes should be implemented in accordance with specific strategy for the area and its boundaries.

(B) Ecosystem management

Ecosystem management is used in the sense of protection and maintenance. It refers to the integrated management of natural landscapes, seascapes, ecological processes, wildlife species, human activities and threatened values, both within and adjacent to the reserve area. Ecosystem based management of the biosphere reserve provides a powerful philosophical and technical basis for the stewardship of the reserve and surrounding communities, as well as for society at large. At a maximum, the ecosystem approach should encompass the following steps:

1- Setting ecologically and socially desirable goals and measurable targets, e.g. conservation, restoration and sustainable use of biotic and abiotic resources.

2- Development of management strategies that transcend political boundaries, e.g. inclusion of the reserve in regional land use planning.

3- Application of cooperative management practices that are compatible with maintaining the integrity of the reserve with the surrounding areas.

4- Establishment of research and monitoring / early warning programmes to assess the effectiveness of management strategies.

To ensure the maintenance of the reserve, it should be included in the local planning and decision-making processes and structure of the region or surrounding areas. Otherwise, the regional development activities (in Hurghada and Ain Sokhna) will systematically encircle and encroach on the reserve. Land use planning must deal with an array of ecological concerns and human activities within and outside the reserve. The planning process should be flexible allowing for the use of traditional and local ecological or environmental

deteriorate rapidly if measures are not taken promptly to conserve the natural resources.

Design of the biosphere reserve

The following design of the reserve (Figure 2) is suggested. Since the area is more homogeneous, a single large reserve is likely to conserve more species and habitat types. Designation of zones for the biosphere reserve includes:

(1) ***The core zone.*** Two core zones are suggested: *First*, the mountainous core zone; and *Secondly*, the coastal-marine zone. The two zones support a full complement of biodiversity and habitats typical of the ecosystems under protection.

(2) ***The buffer zone.*** This zone serves to protect the core zone from destructive human activities and expected to support and acts as a reservoir for the recruitment of wildlife populations to other parts of the biosphere reserve. Activities prescribed for the buffer zone include research, monitoring, education, training, recreation, ecotourism and traditional land use by indigenous people.

(3) ***The transitional zone***. The zone should contain human activities that are more intensive than those occurring in the buffer zone but still not excessively destructive to the natural environment.

Protection measures and management considerations

Establishment of the area as a biosphere reserve without setting its management criteria does not guarantee its protection, particularly the area can not be isolated as a self-contained ecological unit in a pristine condition. Recent developments in the region and human activities may contribute to the degradation of the area's natural and cultural resources. A management plan is essential and should be ecologically sound, socially relevant and considering the threatened values of the area.

(A) Actions required

To ensure that ecological integrity of the area is maintained, a number of specific actions are required. These include:

1- Programmes must be administered on sound scientific bases. Contribution to maintaining the area's ecological integrity must take priority over traditional developmental mandates.

2- The benefits of the area protection must be identified and communicated to the public and government.

3 -Responsible agencies and authorities must build accountability for the maintenance of ecological integrity within and adjacent to the target area.

region. Today, these cultural heritage sites represent in themselves an irreplaceable treasure of great scientific, historical, anthropogenic and socioeconomic significance.

Roman trade routes across the northern eastern desert were used for exporting quarried stones. The Romans scoured their empire for the finest stone, finding the best porphyry on Mons Prophyrites in Gebel Dukhan and the finest grandoirite at Mons Claudianus. The Romans drag their stones about 225 km across the eastern desert in ships on the Nile. Available technology during this time consisted of wooden wedges, metal tools and oxen and camel drawn wagons confirms a marvelous superhuman determination. Archeological relicts of both quarries at Mons Prophyrites and Mons Claudianus are included and highly recommended in current tourist programmes.

13- Threats and the urgency for protection

The area is threatened because of the extensive and intensive development activities in the region (Hurghada and Suez Gulf). Mining and quarrying, and oil exploration and production will lead to the alteration of the natural state of the whole region, if no efforts are made to retain some of its natural elements and highlights the true value of the area. The other important current and impending activities, which represent a threat to the area, include: overgrazing, illegal hunting, uncontrolled mass tourism activities, overuse and off-road vehicle driving by exploration companies, tourist safaris and researchers, abuse of historical and archeological sites, and environmentally unplanned development.

The current development activities in the region will change most of the coastal and marine habitats. Establishing of BR to cover both terrestrial and marine habitats will protect the remaining natural ecosystems in the area, before substantial damage takes place, so that it becomes an integral part of the developed areas in the region.

There is a general lack of protection of archeological and historical sites in the area, which renders them susceptible to tampering and looting by visitors. This may result in loss of valuable data and archeological information.

The flora and fauna of the area is typical of mountain deserts and include several rare and endangered species. Ibex and Dorcas Gazelle are both still present in moderate numbers. The region falls along a primary migration route for migratory soaring birds, which fly over the area in vast numbers and use many coastal and mountainous sites for resting and staging.

It is important to declare the area as a biosphere reserve, to coincide with and enhance the current development impetus in the region. The role of the proposed BR should be taken into consideration in any planning process for the region. This will expand the region's economic base. Moreover, given the heavy development pressure, the landscape and seascape resources will

10- Local and government support

Protection of the area was recommended in the consultation report "*Towards establishing a network plan for protected areas in Egypt*", Nature Conservation Sector, Egyptian Environmental Affairs Agency, 1999. Local people involved in tourism related activities and other development activities in the area, all in favour of establishing a biosphere reserve to ensure conservation of their culture and heritage as well as sustainable use of the natural resources.

Current unregulated tourism activities in the area is heavily associated with the collection of artifacts and stone souvenirs from the historical and archeological sites as well as uncontrolled mountaineering and safari driving, which are leading to deterioration of the area. The local people see that, establishing the area as BR will lead to the diversification of land use and open new jobs for their people. The BR will keep the area from the different development activities in the region.

11- Land use and tenure

The area is occupied by the Ma'aza tribe including the Khushmaan. These comprise about twenty clans living on almost freehold land. Bedouin life is focused on the high mountains and the watercourses (*Wadis* or valleys). The number of inhabitants in the area is about 800 individuals scattered in small groups. The natural ecosystems in the area support the nomads' herds. The inhabitants practice multi-resource nomadism. Their major activities are herding, collecting plants and hunting. Whenever possible, the Bedouins take the advantage of rainfall and other water resources in growing some ephemeral crops in very small gardens. The shortage of water prevents agriculture from having a significant regular place in their economy.

Beside the pastoralism ,men work as guards for oil installations, railways, and other utilities and as road builders, drivers, miners and wage labours in towns. Recently, some clans earn more income from running the safari stations which represent a major recreation activity in the area. The wives and children remained in the desert with the family's livestock. Some men have their families and herds in the desert close to their place of work.

The major land use activities are: (1) grazing and collection of plants; (2) hunting of birds and mammals; (3) mining and quarrying for limestone, marble and other rocks or minerals; and (4) tourism based activities.

12 - Cultural and archeological value

The area of Shayeb El-Banat Mountain group has a wealth of cultural heritage resources, most notable are the ancient Roman quarries and the settlements on Mons Claudianus. The region has long attracted man to utilize and extract its riches of raw materials and mineral ores. The area encompasses a complex network of historical routes, mines, settlements, forts and wells that were used over millennia to facilitate the utilization of natural resources of the

The proximity of the area to Hurghada city with its educational and research institutions, e.g. schools and Marine Sciences Institute, as well as the accessibility of the area will facilitate the use for scientific and educational purposes.

9- Ecotourism

The preferred and common type of tourism in the area is known as ecotourism (ecology-based tourism), defined as traveling to relatively undisturbed or uncontaminated natural areas with the specific objective of studying, admiring, and enjoying the scenery and wildlife, as well as any existing cultural manifestations.

Ecotourism has proven to be a powerful conservation force in many parts of the world, providing an economic incentive for protecting environment and wildlife. Because of the increased awareness, the term ecotourism has become synonymous with a preferred ethic and higher environmental consciousness among tourists.

The attractive natural and man-made environments in the area from the foundation of the ecotourism industry. The natural environment in the form of marine, coastal and mountainous ecosystems, and the man-made environment, which include sea-side resorts in the surrounding area and the *in situ* safari stations, are vital foundations for the success of ecotourism. Beside the breathtaking scenery of the landscape and seascape, the warm sunny beaches of the Red sea create attractive sites.

Based on the relationship between the environmental resources and visitors in the area, four categories of ecotourism can be practiced:

(a) ***Ethnic and cultural tourism***, attracting visitors to view the quaint customs and traditions of remote groups and tribes.

(b) ***Historical tourism***, centered around visits to heritage, historical and archeological sites.

(c) ***Environmental tourism***, attracting a high income elite to remote pure environments. Practicing marine sports and mountaineering are major activities.

(d) ***Recreational tourism***, comprising mass holding participation and often involving imported labor, changes in land use and heavy demands on the local communities.

Beside the economic benefits, environmental benefits are found to arise from ecotourism services and facilities, such as improved communication systems, health care and water supplies for the local populations.

structural, functional and genetic variations. This behviour enhances the preservation of the overall genetic diversity of the species. If any population subjected to destruction due to catastrophic disturbance such as drought or other unpredictable events, a recolonization will be more rapid from the remaining populations of the species. The keystone species support large numbers of insects, birds and fruit-eating mammals which in turn are interdependent with other plants. Some of these species set their seeds during summer, autumn, winter or spring. This spatial and temporal variation of seed production and vegetative growth, ensure food for consumer animals around the year.

7- Importance for promoting sustainable economic output

Beside its function in conserving the natural resources, the BR will conserve outstanding landscape and seascape to support and complement the tourism industry in the region, by maintaining the quality of the environment and providing attractions to visitors. Sustainable development of biotic and abiotic natural resources will ensure the long-term sustainability of other economic activities in the region, by introducing and creating new nontraditional economic base. The Br will help find an equilibrium between contemporary growth and development needs.

The traditional and cultural heritage of the local inhabitants is valuable part of Egypt's cultural heritage. The BR will help establishing a system for integrating the local populations in management and conservation efforts. This will maximize the local community benefits from the natural resources of the area in a wise and sustainable fashion. More important is, the BR will work as a buffer between the two highly consumptive and spatially imbalance development in Hurghada and Ain Sokhna, providing permanent natural attractions.

8- Scientific and educational value

Variation of the topography in the landscape and seascape is a feature of scientific and educational interest for the area. The area provides wide range of marine, coastal and inland material for both scientific and educational purposes, that include landscape, seascape, biotic and abiotic components, an important asset for increased ecological diversity. This would provide a baseline for comparative and integrated purposes. The outstanding landscape and diverse marine habitats are unique, and an understanding of the processes in operation there is essential for both introductory outdoors activities among young students and more serious educational and tramping for senior students; the latter including instruction in leadership, meteorology, geology, botany, zoology, archeology, history, anthropology and marine biology. The attitude towards outdoor education as an important and integral part of the curriculum is an advance from the view where field exercises acted to supplement the normal school programme. Fortunately, the free hold land among the inhabitants and the traditional forms of land use will run no conflict with both educational and scientific use of the area.

contain some of the common and widespread species. Different ecosystems in the area contain many representative species in similar habitat types.

6- Benefits of protection

I -*Direct benefits.* The greatest traditional part of the direct benefits is the use of biodiversity (flora and fauna) for its medicinal value, firewood supply, grazing value and edible wild fruits. Livestock production by grazing and browsing animals, where the area supports about 100 camels, 50 donkeys, 1000 goat and sheep heads, and few cattle. Despite this low number of livestock, they play an important role in the economy of the local people. The mountainous ecosystem represent a catchment area for water resources that support the inhabitants and few visitors use.

II -*Indirect benefits.* The greatest indirect benefit derived from the recreational and scenic values, which are enjoyed all the year round by thousands of tourists. This is true not only in the mountainous ecosystems but also in the seashore and marine ecosystems with its extraordinary wealth of marine life. The scenic and aesthetic values are not easy to assess in monetary terms, although they significantly contribute economic benefits. An important economic contribution comes from safari tourism, which provides jobs and source of income for both local and surrounding urban populations, that dramatically improved the standard of life. An important potential of this area is the procurement of genetic resources of valuable economic, medicinal, forage and ornamental species. A renewed domestication and cross-breeding of some wild plants will become increasingly important in the future. Marine and coastal habitats afford protection to potentially important breeding grounds for fishes, crustaceans, local and migratory birds.

III -*Free ecological services and non-economic richness.* As long as the functional and structural integrity of the natural ecosystems in the area is assured, they will continue to provide ecological and non-economic free services. The value is connected with the capacity of the highland, lowland and marine ecosystems to ensure environmental quality, stability, and health as part of their normal regulative and protective life-supporting functions. Biodiversity resources in the area should not be evaluated in economic terms. As a free gift of nature, acquired during millions of years of evolution, conservation of biodiversity in its natural habitats is needed, where further evolution and speciation can proceed. These non-economic richness and values have great aesthetic, cultural and scientific importance and their loss makes human society much poorer. Because of the various mountainous, coastal and marine ecological diversity, the area can serve as one of the most natural "field laboratories" for field-oriented environmental education. Many activities can be performed such as short courses for organized groups and recreation camps that combine natural history, archeology, diving and mountaineering.

Beside the strict conservation of wildlife in the area for its gene bank value, some species have different populations distributed along an altitudinal gradient, where different populations are more likely to contain individual

The reptiles are represented in the area by about 19 species, almost at risk or endangered, and need protection (Appendix-Table 4).

The area is also rich by the insect fauna. Appendix-Table 5 shows some of the insects found in the area. Some types of beetles, grasshoppers and ants are still common.

At least some 30 species of coral reefs are found in the marine ecosystem (Appendix-Table 6). Both hard and soft corals are found in the area. There are many coral predators including worms, crabs, starfishes, snails, nudibranchs and fishes. Among the fishes, the most notorious coral feeders are parrotfishes, wrasses, butterfly and angelfishes. The sea urchins, particularly, *Diadema setosum*, *Echinometra mathei* and *Heterocentrotus mammillatus* are common grazers in the coral reefs of the Red sea.

4- Naturalness

The naturalness implies the recognition of some natural conditions in a sense that implies freedom from human influence, but few if any, populations of wildlife and natural ecosystems are free from the influence of man. Absence of urbanization and extensive agricultural developments in the area has given a minimum disturbance by man and keeps most of the ecosystems in natural or semi-natural conditions. The limited size of local populations and their use of the products of the ecosystems govern man-environment interaction in the mountainous ecosystems, i.e. they are totally dependent upon, and limited by their environment. On the other hand, in the surrounding coastal and marine area of Hurghada, the intensive and extensive human disruption of ecosystems is threatening the landscape and seascape. This is due to the unlimited size of the human population that implies import of food and building material.

Depending on the degree of naturalness, vegetation in the mountainous area can be classified into three broad categories:

(a) Undisturbed natural, that showed no alteration and usually restricted to inaccessible sites.

(b) ***Disturbed natural,*** have evidently been used for grazing and other human uses, but no marked structural or floristic changes occurred. This type of vegetation dominates the area.

(c) ***Degraded natural,*** have suffered structural alteration, but species are still of native origin. This type of vegetation dominates in mining and archeological sites.

The situation for the vegetation is reflected in the associated biota.

5- Typicalness and representativeness

By its definition a typical ecosystem includes examples of the flora and fauna which would be found widely in such habitats, and thus it will

Threatened plant species

Haloxylon persicum Bunge
Status: Endangered
The species is of scientific interest on account of its limited geographical distribution. It is also recommended by the Bedouins as a plant for shade, wind break in extremely arid deserts.

Moringa peregrina (Forssk.) Fiori
Status: Vulnerable
This taxon is recorded fronm Gebel Abu Dukhan to Gebel El Farayied and recorded from southern Sinai. Partial conservation of this tree could be attributed to its value as a cash crop.

Pistacia Khinjuk Stocks
Status: Vulnerable
The species is of scientific interest being relict of an Irano-Turanian element in the middle Saharo-Sindain region. A decoction of the leaves is taken for many days for the treatment of pains in bones.

Rhamnus disperma Boiss.
Status: Vulnerable
The species is of limited geographical distribution. It grows in places difficult of access for grazing animals. Danger would be from tourists or gradual extinction due to other environmental factors.

Olea europaea L. Subsp. *africana* (Mill) P.S. Green
Status: Endangered
Nanophanerophyte grows in crevices of rocky slopes at high altitudes. Six trees were recorded from Gebel Qattar. It is believed that this site is a relic of previously more luxuriant vegetation.

Teucrium leucocladum Boiss.
Status: Vulnerable
The species was recorded from Gebel Qattar. It is known from south Palestine and Arabia. In Egypt, it is confined to northern parts of the Galala Desert.

(B) Fauna

A total of about 40 bird species are found in the area (Appendix-Table 2). The bird fauna may be resident (about 15 species), passers (15 species), or winter and summer visitors (10 species). About half of the birds in the area are common.

The mammalian fauna in the terrestrial ecosystems of the area is represented by about 20 species (Appendix-Table 3). Some of the mammals are still common. Most of the mammals are threatened or found in few numbers.

Wadi Um Sidr. The valley is an affluent of Wadi Bali which drains into the Red sea from Gebel Abu Dukhan. The main wadi-bed is completely covered by boulders and rocky fragments. Growth of xerophytic plants occurs on sand/clay matrix deposited in spaces between rocks. Common associates include: *Aerva javanica, Arnebia hispidissima, Asphodelus tenuifolius, Citrullus colocynthis, Cometes abyssinica, Forsskaolea tennacissima, Hyoscyamus muticus, Leptadinia pyrotechnica, Pulicaria crispa, Rumex vesicarius, Trichodesma africana, Zilla spinosa, Zygophyllum simplex*. Arboreal vegetation is represented by Scattered trees of *Moringa peregrina, Acacia raddiana* and *Ziziphus spina-christi*.

Coastal Flora and vegetation. The coastal land includes littoral salt marshes and coastal desert plain. The salt marsh vegetation is dominated by *Zygophyllum album, Suaeda monoica, Nitraria retusa* and *Atriplex* sp. The sandy plains and crossing wadis are characterized by *Zygophyllum coccineum , Cornulaca monacantha, Fagonia mollis* and *Erodium* sp. (Appendix - Table 1). Richness of the coastal vegetation is attributed to its favorable water supplies from the surrounding catchment area.

Multi-purpose plant species

The Bedouins depends on drought-enduring perennials for sustenance rather than on annual or ephemeral plants cannot survive prolonged drought in this harsh environment. Plant materials furnish many tools and amenities. Dead vegetation or standing plants make up the wind screen, a sleeping shelter that the inhabitants widely prefer to the wool house.

Salvadora persica L. This tree forms large clumps which is considered as a suitable and recommended place for campsite. The intricate limb network and profilic foliage of this plant provide a fine barrier against the elements.

Acacia raddiana (Savi) Brenan. Branches of Acacia give the Bedouins columns for their wool houses. Smaller sticks could be used to shake down acacia leaves and seed pods to feed livestock. The bark and seed pods traditionally provide tannins for water skins.

Capparis sinaica Veill. The Bedouins eat cappers as they ripen on the lower mountain slopes in late summer and fall.

Ficus palmata Forssk. Wild figs ripen in the mountains in late summer and despite their small size are delightfully sweet. The branches can be used as columns for the Arabs wool houses.

Moringa peregrina (Forssk.) Fiori. Ben seeds have been valued in the Nile Valley especially for the women with its reported purpose of eating the seeds to become fatter. Ben oil is also prized by watchmakers.

Solenostemma argel (Delile) Hayne. The leaves are boiled for tea to settle stomach.

mountains support a unique flora where many rare and endangered species are represented. The marine ecosystem is rich with coral reefs which support diverse marine biota deserve special attention and protection.

3- Species diversity

(A) Flora and vegetation

The present field work and previous floristic studies conclude that the flora of the area includes about 200 plant species belonging to XX genera and XX families (Appendix - Table 1).

Vegetation of the desert track to Gebel Shayeib El Banat mountain group is dominated by *Zilla spinosa* community. The common associates are : *Zygophyllum coccineum, Aerva javanica, Artemisia judaica, Asphodelus tenuifolius, Calligonum comosum, Cleome droserifolia, Citrullus colocynthis, Fagonia mollis and Pulicaria crispa*. In certain parts of the *wadi* ecosystem, scattered trees of *Acacia raddiana and Moringa peregrina were* recorded.

The mountainuous vegetation of the area is rich and diverse rather than any other sites in the region. *Moringa* scrub covers gullies and runnels dissect and network the mountain. Phytosociological analysis revealed that the community of *Moringa* comprises the following associates : *Aerva javanica,Aizoon canariense, Artemisia inculta, Artemisia judaica, Asphodelus tenuifolius, Citrullus colocynthis, Forsskaolea tenacissima, Lavandula stricta, Lindenbergia abyssinica, L. sinaica, Pulicaria crispa, Reichardia orientalis, Robbairea delileana. Launaea spinosa, Lycium shawii, Cleome droserifolia, Trichodesma africana, Capparis spinosa, Ficus palmata, Thymus bovei and Hyoscyamus desertorum.*

Wadi Irn. The valley is one of the most important wadis dissecting the south eastern slopes of Gebel Shayeb El Banat. It stretches from the bottom till the top of the mountain providing a physical variable affect the plant cover on different elevations. The downstream part of this wadi includes scattered bushes of : *Aerva javanica, Artemisia judaica, Cleome droserifolia, Echinops spinosus, Forsskaolea tenacissima, Launaea spinosa, Lycium shawii, Trichodesma africana*. A few scattered trees of *Moringa peregrina* and *Ficus pseudosycomorus* were recorded on high elevations. These trees are relatively protected since they are growing in inaccessible niches.

Wadi Qattar. The valley extends from the southwestern slopes to the southeastern slopes of Gebel Qattar, 9.7 km long. Threatened trees were recorded from South eastern gorges of the wadi, namley: *Haloxylon persica, Pistacia khinjuk* and *Olea chrysophyla*. Plant cover of the southwestern section of the wadi comprises the following taxa: *Aerva javanica, Artemisia judaica, Pulicaria crispa, Fagonia mollis, Lavandula stricta, Lycium shawii, Zygophyllum coccineum, Reseda sp.* Few trees *of Moringa peregrina* and *Ficus pseudo-sycomorus* are growing in crevices across the wadi.

resorts. Unfortunately, most of the development activities took place with little or no regard to the surrounding natural environment. The intensive development activities exerted many negative impacts on coastal and marine habitats.

2- *Tourism and recreation*. Intensive tourism and related marine and coastal recreation activities and sports have many ecological implications that resulted in destabilization of some sites.

3-*Oil pollution*. Oil enters the marine and coastal areas from exploratory and production wells, oil-field blow-outs, tankers and pipeline break-ups.

4-*Dredging and coastal in filling*. Dredging for marine oil and gas exploration and production, and platform constructions results in many disturbed sites. Many natural sites have been lost due to extensive in filling and reclamation of coastal areas for different purposes.

5-*Over-fishing and illegal fishing*. Fishing has been a long-standing practice in the area. Over- fishing and illegal fishing are causing acute deterioration of many fish species and associated biota.

6- *Diversion of freshwater run-off*. Various activities in the catchment areas and valley downstreams, such as road and sea side resort construction, have altered the sporadic run-off water inflows into the sea. These activities have severely disrupted the coastal and marine ecosystems.

Assessment of protection and conservation value

1- Location and size

The area encompasses mountainous, coastal and marine ecosystems. The total area of the proposed biosphere reserve (BR) is around 4000 km^2. The number of species encountered increases as the increased size of the area. Since the area is large and characterized by diverse habitat types, it can be designed as single large reserve, that contain optimum number of species at different trophic levels. The potential large size of the reserve is advantageous as it decreases the chance of species loss or extinction and favour the species occupying higher trophic levels. Most predators require larger areas than their prey. Also, the area contain populations of plants and animals which are diverse enough to represent the genetic variability of the populations and to persist indefinitely. Since drought is a normal condition, large size of the reserve ensures the availability of greed feed for grazing animals.

2- Position ecological / geographical units

The area represents a unique biogeographical transitional zone where elements of several biogeographical regions coexist and overlap, which contributes to an increased diversity in biological elements and the scientific importance of the region. It holds some of the most important and characteristic plants, mammals, birds and reptiles of the region. The high

(B) Human impacts

I. Terrestrial ecosystems

1- *Uncontrolled tourism and recreation.* Intensive tourism in the area and its surroundings revealed varying degrees of impact caused by the unsympathetic building styles, noise, pollution, over-crowding, water shortages, damage of flora and fauna, disturbance of many sites and heritage resources. The off-road driving in desert safaris jeopardize the ecosystems and destroy the wildlife habitats.

2- *Overgrazing and collection of plants.* Grazing by livestock such as goats, sheep. camels and donkeys has been a long-standing practice in the area. Heavy grazing and collection of plants for commercial use are causing acute deterioration of many species. Overgrazing is an aspect that threatens not only plants but also the herbivores dependent on them. Overgrazing continues to pose difficulties in controlling it, due to low land productivity, increased number of animals and frequent drought. Heavy collection of plants in the area goes back to the Roman time. The Romans overused the trees and shrubs of *Acacia raddiana, A. ehrenbergiana, Capparis decidua* and *Leptadenia pyrotechnica.*

3- *Over-exploitation of resources.* The practice of selective and over-collection of the flora and fauna as carried out by outsiders, strangers and herbalists is leading to the decrease of many plant and animal species populations. Selective lumbering and wood collection as fuel, or for rural constructions and other purposes by nomads and local people hasten the degradation and disappearance of many trees and shrubs. Many plants and animals are collected for folk medicine or superstitious reasons, in the belief that their parts will have medicinal or magical powers or impart sexual vitality and strength. Drought is another stimulus for people to overexploit the perennial vegetation. Under the pressure of prolonged drought, the nomads only alternative to working for wages or settling outside the desert is to overuse the drought enduring or surviving resources of the perennial flora.

4--*Illegal hunting and poaching.* The future of some species is endangered due to illegal hunting and poaching. The use of sophisticated hunting tools and modern vehicles are devouring all forms of wildlife in their paths.

5--*Mining and quarrying.* These activities are conducted without environmental impact assessment. This resulted in destruction of many sites, serious disturbance of many habitats, that reduces the distribution of many plant and animal species, and permanently scarring the highly attractive landscape of the area.

II. Coastal and marine ecosystems

1- *Coastal development.* In recent years. The Red sea coast has witnessed a development bloom extends from Ain Sokhna to Safaga. from a quaint pristine coasts to sprawling densely populated beaches with many seaside

Cultural settings and human impacts

(A) Culture

Inhabitants of Gebel Shayeb El Banat area belong to the Ma'aza tribe, where the Ma'aza are known as Bani Attiya. Their clan, a sub-unit of the tribe is the Khushmaan. All clan members living today are descended from a common male ancestor of twelve generations whose name was El-Khashm. Their home is the Eastern Desert of Egypt, between the Nile River and the Red Sea, covering an area about 90,000 sq km. The number of human inhabitants (exclusively nomadic Bedouins)is more than one thousand, i.e. one person per 90 sq km. This is one of the lowest population densities on earth. The Khushmaan are pastoral nomads. Pastoral in that they raise sheep, goats, and camels. They have no fixed dwellings.

The Khushmaan who dwell in the desert raise sheep, goats, and camels. There is a strict sexual division of labor in Khushmaan animal herding. While tending camels is men's work, herding sheep and goats is the duty of women and children. They also hunt, collect edible and marketable wild plants, cultivate crops, and work for wages. Income from the sale of sheep and goats is the backbone of the khushmaan economy. The nomads sell livestock to Qena's market or Qoseir's market.

Growing crops is another non-pastoral opportunity the nomads take advantage of whenever possible. They cannot sow crops randomly, but must prepare special plots which they can tend only if rain falls on them. This harsh environment (unsuitable topography and accidental rainfall) prevents agriculture from having a significant and regular place in their economy. Most often planted crops are barley, millet, maize, watermelon, sweet-melon, cucumber and okra.

By the standards of a Muslim Village, the Bedouins appear not to be very fastidious. Other than older men and women, few pray the prescribed five times daily. Prayer and pilgrimage are not adequate indicators of the nomads' spiritual life, for they are deeply religious and thank God constantly.

Water is the nomad's most important resource. The Khushmaan regard their homeland as exceptionally well endowed with this precious commodity. It is, but only in comparison with even more desiccated surrounding areas. To the Ma'aza, the finest water source is the dripping place "naggaat in Arabic". The droplets for which these places are named fall ceaselessly from cliffs to irrigate ferns, mosses, rushes and reeds. These drippings feed permanent, shaded pools of water to which ibex, birds and people come regularly.

The Khushmaan have few wells, but they sometimes dig a new one or excavate an ancient well. Some date from Roman times. One of these, Bir Qattar, is so deep at an estimated 50 m. A greater portion of the nomad's permanent water supply comes from surface water than from wells. Another permanent supply is the gravel seep from which a must scrape away sand to expose the precious liquid.

In the main *Wadis* (valleys), the soil is mainly composed of transported material ranging from fine sand to rock fragments. The material is less mobile and the xerosere has progressed until the last vestiges of the boulders have disappeared under the accumulating soil.

Climate

Climate data from the surrounding meteorological stations (Hurghada, Suez and Qena) show that the climate is arid. Rainfall is scanty. The annual average of rain ranges from 25 mm in Suez, 5.2 mm in Qena to 4 mm in Hurghada. Temperature is high and ranges between 14.0-21.7 °C in winter and 23.1-46.1 °C in summer. Relative humidity ranges from 43% in summer to 65% in winter. North winds cross the 65 km stretch of the Gulf of Suez before reaching to the area. East winds cross the 200 km stretch of the Red sea before reaching to the mountain range of the area.

Hydrology

The water sources in the area are mainly rainfall and underground water. Beside the convectional rainfall, the high mountains receive orographic precipitation. The valleys and lowlands receive run-off water from the highlands. Dry waterfalls and potholes are common features in the mountainous and valley ecosystems in the area. In the valleys running at the feet of the mountains there are several shallow wells of fresh or brackish water. On the slopes or cliffs of the mountains, there are cracks from which continuous trickle of water oozes. The course of runnels dissecting the slopes of the mountains may contain potholes that are periodically filled with rain water.

(B) Seascape

The shoreline of the Red sea is characterized by a chain of coral reefs, the width of which may exceed 100m in some localities. The basic type of corals is the fringing reefs, which vary greatly in size. The reefs are penetrated at intervals by narrow channels called *Marsas*. The area is transacted by scattered corals of various size, some are formed around subsurface topographic rises. Many reefs are exposed during the semi-diurnal low tide and many reefs are fringed from the shore. The reefs have developed along roughly parallel ridges oriented from south-south east to north-north west.

The environmental role of the coral reefs in the area includes :*First*, they exert a controlling influence against coastal erosion; *Second*, they create diverse microsites as nursery grounds and spawning habitats for fishes and other marine fauna; and *Thirdly*, by association with the maintenance of biota, they constitute an important genetic reservoir.

3-An intermediate element, the regolith, which covers the mountain slope or forms deposits on the valley bottoms, plains and lowlands.

4- The coastal area which is organized into littoral marshes and coastal desert plains.

Throughout the mountain system, a downward course of valley and tributary system is created and cutting the mountainous slopes. In this downward course, the boulders and gravel are gradually sorted and worn so that a decreasing size is evident until finally in the valley beds, only coarse and fine sands and silt are found, where the braided pattern is lost. The main *Wadis* that determine the basic form of the eastward drainage system comprises Um Anab, Irn, Qattar, Um Sidr, Um Dhalfa, Bali, Al Atrash, Um Araka and *Wadi* Mallaha. Every main *Wadi* is supported by a tributary network which have different orientation. The *Wadi* and tributary system is complementary and shapes the mountainous relief in the area. This shaping involves the removal and relocating of rock fragments ranging in size from very fine material to huge boulders.

The intermediate element is a system of deposits, a regolith, where most of the material carried from the mountains through *Wadis* and tributaries is in the form of fine material and has been transported to the plains and coastal belt. He deposit system is of great importance for it forms the substrate on which the soils and vegetation develop.

The coastal area is organized into coastal desert plain and littoral salt marshes extend between the mountains and the Red sea coastline. The coastal desert plain consists of different gravel, sandy and flat sites. The plain is dissected by valley system that originate in the mountains and run eastwards into the Red sea and Suez Gulf. The downstream parts of the valleys are characterized by fine sediments and high salt contents. The midstream and upstream parts of these valleys are characterized by non-saline coarser sediments.

The littoral salt marsh comprises the areas bordering the sea and are subject to maritime influences, *i.e.* tidal inundation and sea water spray. The substratum of these areas is saline.

Soil

The soil is very rocky on the crests and ridges. The bedrock is covered only with a jumble of large rock fragments, which represent the first stage in the change from rock to soil. The bedrock is exposed in many places and the fine soil material is only confined to pockets and cracks among the outcrops.

The slopes and downward course of valley and tributary system are covered with mixture of rock fragments varying in size, and loose gravel, forming a cover which protects the underlying material that has accumulated among the boulders from transportation and erosion.

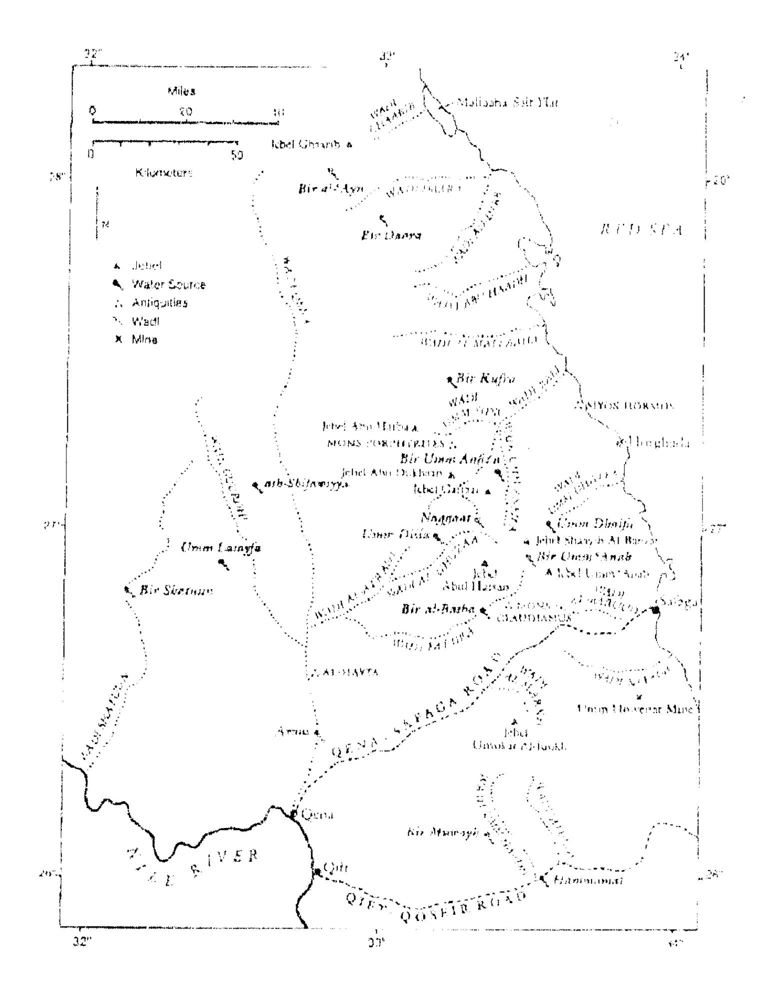


Figure 1: Principle site locations in Shayeb El-Banat mountain group and the coastal areas.

Geomorphology

In examining the topography of the area, it is convenient to recognize four elements:

1-The mountain system (Gebel Shayeb El-Banat group) consisting of peaks, ridges, crests, slopes, cliffs and cracks, largely reflecting an outstanding diverse system of habitats.

2-The valley (*Wadi*) system which drains the mountain system, and carries the products of erosion out of the mountains.

Sokhna is expected to be among the largest industrial regions in the Middle East. These two development areas are expected to create large scale and rapid negative impacts on the surrounding natural marine and terrestrial ecosystems. Sustainable development in the two regions requires healthy natural areas to support the regional resource development activities and ensures the protection of its natural and scenic values.

There is an urgent need for an integrated approach to multipurpose land use in the region, aiming at reconciliation between the need for conserving the productivity of the natural ecosystems and the socioeconomic needs of the local people and national economy. This will ensure the highest overall benefits and will be flexible enough to leave options for environmentally sound landscape / seascape development considerations.

OBJECTIVES

Within the framework of UNESCO's MAB activities addressed to the implementation of the Seville strategy, the main objectives of this study are to: (1) Provide a preliminary assessment on biodiversity and environmental setting of Shayeb El-Banat mountain group; (2) Identify and delineate the landscape / seascape units that are to provide a framework for the different zones of the proposed biosphere reserve (core, buffer and transitional zones); and (3) Suggest protection measures and management considerations.

Environmental setting

(A) Landscape

Geography

The proposed area encompasses the mountain country west of Hurghada, roughly from the Qena-Safaga road in the south to wadi Mallaha in the north, and from the eastern fringes of *Wadi* Qena in the west to the coastal plain of the Red sea in the east. The complex of Gebel (mountain) Shayeb El-Banat comprises four major mountains, namely: from north (Lat. 27° 20'N) to south (Lat. 26° 30'N) Gebel Abu Dukhan (1705 m a.s.l.), Gebel Qattar (1963 m a.s.l.), Gebel Shayeb El-Banat (2187 m a.s.l.), Gebel Um Anab (1782 m a.s.l.). Gebel Shayeb El-Banat is the highest peak within the Red sea coastal mountains of Egypt. This group facing the southern part of Suez Gulf and the northest part of the Red sea proper (Figure 1)

SHAYEB EL-BANAT MOUNTAIN GROUP ON THE RED SEA COAST: A PROPOSED BIOSPHERE RESERVE

Ahmad K. Hegazy[1*], A. G. Fahmy[2] and H. A. Mohamed[3]

[1]Professor of Conservation and Applied Ecology, Botany Department, Faculty of Science, Cairo University, Giza 12613, Egypt;
[2]Botany Department, Faculty of Science, Helwan University, Cairo, Egypt;
[3]Zoology Department, Faculty of Science, Cairo University, Giza, Egypt.
(*corresponding author)

ABSTRACT

The Red Sea region in Egypt is currently witnessing a rapid development rate. Development activities are usually associated with alteration of the physical and natural landscape and seascape of the region. Conservation of natural resources in the region is needed to maintain the economic output and ensure the long-term sustainability. The future of the current development in Hurghada and Suez Gulf areas is dependent on conservation and sustainable use of the natural resources in the surrounding areas. Declaration of Shayeb El-Banat Mountain group area and a representative marine site as a biosphere reserve will ensure healthy environment to support the development activities and protect the natural and scenic values of the region.

This study summarizes the environmental and cultural settings of the area. The major human impacts on terrestrial and marine ecosystems are reviewed. Assessment of the protection and conservation value of the area as well as its natural history suggests its designation as a biosphere reserve. This judgment is based on analysis of different criteria for evaluation of conservation values. The evaluated criteria include: Location and size, position in ecological / biogeographical units, biological diversity, naturalness, typicalness and representativeness, benefits of protection, importance for economic output, scientific and educational values, ecotourism, local and government support, land use and tenure, cultural and archeological values, threats and urgency for protection.

A proposed design of the biosphere reserve is suggested covering both terrestrial and marine ecosystems. Considerations for protection and management of the biosphere reserve are outlined, that cover the actions required and ecosystem management. A set of recommendations is outlined.

INTRODUCTION

The Red sea region of Egypt is planned for a multidisciplinary developmental activities. Two planned areas include Hurghada and Ain Sokhna are under intensive and extensive development. Hurghada is designed to provide a wide variety of marine and landscape recreation activities. Ain

Watt, J.M. and Breyer-Brandwijk, M.G. (1962) *The medicinal and poisonous plants of southern and eastern Africa.* 2nd Edition, E. & S. Livingstone Ltd., London

Della Logia, R., Del Negro, P., Tubaro, A., Barone, G. and Parilli, M. (1989) *Planta Medica*, 55, 587.

Dry, J., Poynton, M., Thompson, M.E. and Warren, F.L. (1958) *Journal of the Chemical Society*, 4701-4704.

Farnsworth, N.R. and Soejarto, D.D. (1991) Global importance of medicinal plants. In: Akerele, O., Heywood, V. and Synge, H. (Eds.). *Conservation of medicinal plants*. Cambridge University Press, UK.

Gerstner, J. (1938) *Bantu Studies*, 12, 321-342.

Gerstner, J. (1939) *Bantu Studies*, 13, 49-64.

Gerstner, J. (1941) *Bantu Studies*, 15, 369-383.

Giess W. and Snyman, J.W. (1972) *The Naming and Utilisation of Plantlife by the Zul'Hoasi Bushmen of the Kau-Kauveld*. Verlag, Hamburg.

Hulme, M. (1954) *Wild Flowers of Natal*. Shuter and Shooter, Pietermaritzburg.

Jacot Guillarmod, A. (1971) *Flora of Lesotho (Basutholand)*, Verlag, von Cramer, Lehre.

Kellermann, T.S., Coetzer, J.A.W. and Naude, T.W. (1988) *Plant Poisonings and Mycotoxicoses of Livestock in Southern Africa*. Oxford University Press, Cape Town.

Koorbanally, N., Mulholland, D.A. and Crouch, N. (2000), *Phytochemistry*, 54, 93-97.

Loubser, L. and Zietsman, P.C. (1994) *South African Journal of Science*, 90, 611-612.

Mander, M. (1998) *Marketing of Indigenous Medicinal Plants in South Africa. A Case Study in KwaZulu-Natal*. Food and Agricultural Organisation of the United Nations, Rome.

Mason, L.H., Puschett, E.R., Wildman, W.C. (1955) *Journal of the American Chemical Society*, 77, 1253-1256.

Neuwinger, H.D. (1994) *African Ethnobotany. Poisons and Drugs*. Chapman and Hall, London.

Page, B. (1998) Extractives of Southern African Medicinal Plants. *M.Sc. dissertation*, University of Natal, Durban, South Africa.

Pettit, G.R., Gaddamidi, V., Goswami, A. and Cragg, G.M. (1984) *Journal of Natural Products*, 47, 796-801.

Plowes, D.C.H and Drummond, R.B. (1990) *Wild Flowers of Zimbabwe*. Longman, Zimbabwe.

Pole-Evans, I.B. (1938) *Flowering Plants of South Africa*, 18, t.712.

Pujol, J. (1993) *The Herbalist Handbook*. African Flora Medicinal Plants, Jean Pujol Natural Healers Foundation, Durban.

Sewram, V., Raynor, M.W., Raidoo, D.M. and Mulholland, D.A. (1998) *Journal of Pharmaceutical and Biomedical Analysis*, 18, 305-318.

Sewram, V., Raynor, M.W., Raidoo, D.M. and Mulholland, D.A. (2000) *Journal of Pharmaceutical and Biomedical Analysis*, 24, 133-145.

Tanahashi, T., Poulev, A. and Zenk, M.H. (1990) *Planta Medica*, 56, 77-81.

Veale, D.J.H., Furman K.I. and Oliver, D.W. (1992) *Journal of Ethnopharmacology*, 36, 185-191.

Vildomat, F., Bastida, J., Codina, C., Nair, J.J. and Campbell, W.E. (1997) In: *Recent Research Developments in Phytochemistry*, Pandalai, S.G. (Ed.), Research Signpost Publisher, Trivandrum 1, 131-171.

Watt, J.M. (1967) *Lloydia*, 30, 1-22.

as toxic, particularly to stock (Watt and Breyer-Brandwijk, 1962; Kellermann *et al.*, 1988). Bulbs are used to treat nervous conditions in children and as a treatment for dysentery (Watt and Breyer-Brandwijk, 1962). Diluted bulb decoctions are used as analgesics and to treat rheumatic fever (Bryant, 1909). The Tswana use the cooked bulbs mixed with porridge for the treatment of infertility in women (Jacot Guillarmod, 1971).

Homoisoflavanones were isolated from both species (Bangani *et al.*, 1999; Crouch *et al.*, 1999). In addition, two stilbenoids were also isolated from *Scilla nervosa.* Homoisoflavanones have been shown to have anti-histaminic (Amschler *et al.*, 1996) and anti-inflammatory properties (Della Logia *et al.*, 1989) and this would account for some of the ethnomedicinal uses of these two species. Resveratol, one of the stilbenoids isolated, is known to have anti-oxidant properties. This compound is also isolated from red wine and is reputed to give red wine some of its therapeutic properties.

Acknowledgements

We wish to acknowledge the input into this work by present and former research students: Vuyisile Bangani, Vikash Sewram, Bronwen Dekker, Jonathan Chetty and Neil Koorbanally and colleagues Mark Raynor and Deshandra Raidoo. The DEAT is thanked for supporting the development of MEDBASE, the National Medicinal Plants Database for South Africa. Traditional Healer Elliot Ndlovu has supported Zulu ethnomedicinal usage investigations associated with these plants. The research projects described above were funded by the University of Natal Research Fund and the Foundation for Research Development.

REFERENCES

Amschler, G., Frahm, A.W., Hatzelmann, A., Kilian, U., Muller-Doblies, D. and Muller-Doblies, U. (1996) *Planta Medica*, 62, 535.

Arnold, T.H., Prentice, C.A., Hawker, L.C., Snyman, E.E., Tomalin, M., Crouch, N.R. and Pottas-Bircher, C. (2001) *Medicinal and Magical Plants of Southern Africa: an Annotated Checklist.* Strelitzia 11. NBI, Pretoria.

Bangani, V., Crouch, N. R. and Mulholland, D.A. (1999) *Phytochemistry*, 51, 947-951.

Batten, A. and Bokelmann, H. (1966) *Wild Flowers of the Eastern Cape Province.* Books of Africa, Cape Town.

Bryant, A.T. (1909) *Annals of the Natal Museum*, 2, 1-103.

Charlson, A.J. (1980) *Journal of Ethnopharmacology*, 2, 323.

Chetty, J. (2001) The Chemistry of *Brunsvigia radulosa* and *Cyrtanthus breviflorus, M.Sc. dissertation*, University of Natal, Durban.

Crouch, N.R., Bangani, V. and Mulholland, D.A. (1999) *Phytochemistry*, 51, 943-946.

Cowling, R. M. and Hilton-Taylor, C. (1994) *Strelitzia*, 1, 31-52.

Cunningham, A.B. (1988) *An investigation of the herbal medicine trade in Natal/ KwaZulu.* INR Investigational Report No 29, University of Natal, Pietermaritzburg, South Africa.

tribal chiefs (Pole Evans, 1938; Gerstner, 1941) or used as a putty and adhesive (Jacot Guillarmod, 1971; Giess and Snyman, 1972).

Although *Ammocharis coranica* apparently harbours psychoactive constituents, these have not been pharmacologically characterised. It is speculated that crinamine may account for the reputed calming or hypnotic effects given that this compound has also been isolated from *Dioscorea dregeana*. Furthermore, crinamine is common to *Brunsvigia radulosa* Herb. (syn. *B. cooperi* Baker)(Dry *et al.*, 1958), which is considered to be narcotic (Loubser and Zietsman, 1994). Although CNS effects are attributable to bulb constituents, aerial leaves of *A. coranica* are reputedly grazed by stock (Batten and Bokelmann, 1966; Plowes and Drummond, 1990), suggestive of alkaloid localisation in the plants.

Previous investigations of *Ammocharis coranica* have yielded lycorine, caranine, acetylcaranine, buphanisine, *epi*buphanisine, buphanidrine, ambelline, crinamine, 6-hydroxy-crinamine, *epi*vittatine. In addition to these we isolated 1-O-acetyllycorine, hippadine, 6?-hydroxypowelline, hamayne and the novel alkaloid, 1-O-acetyl-9-norpluviine and four cycloartane compounds: 24-methylenecycloartan-3?-ol, cycloeucalenol, cycloeucalenone and 24-methylenepollinastanone (Koorbanally *et al.*, 2000).

The early usage of *Brunsvigia radulosa* is illustrated by the presence of rock paintings of this species in western Lesotho (Loubser and Zietsmann, 1994); accordingly *Brunsvigia radulosa* is believed to induce a psychoactive state when consumed. Extracts from the plant have been shown to be effective against murine P-388 lymphocytic leukemia in mice (Charlson, 1980). Previous investigations of this species have yielded the alkaloids, brunsvigine, galanthamine, lycorine and also crinamine (Dry *et al.*, 1958; Tanahashi *et al.*, 1990; Viladomat *et al.*, 1997). We re-investigated the plant and isolated lycorine, 1-O-acetyllycorine, crinine, crinamine, hamayne, and anhydrolycorinium chloride (Chetty, 2001). Anhydrolycorinium chloride has earlier been shown to be a potent antineoplastic agent (Pettit *et al.*, 1984).

Investigations of two Hyacinthaceae species: *Scilla natalensis* and *Scilla nervosa*

Scilla natalensis and *Scilla nervosa* are both extensively used medicinal plants in southern Africa. *Scilla natalensis* is used by the Zulu as a purgative (Gerstner, 1939) and to facilitate childbirth (Gerstner, 1941) although the plant has been reported as being toxic to sheep (Kellermann *et al.*, 1988). The Sotho eat cooked bulbs as an aperient, and use bulb decoctions as enemas in the treatment of internal tumours and to treat lung sickness in cattle (Jacot Guillarmod, 1971). The powdered bulbs are rubbed over sprains and fractures by the Southern Sotho and the Tswana rub powdered bulbs into the back, joints and other body parts with the belief that it makes them strong and resilient to witchcraft (Watt and Breyer-Brandwijk, 1962).

Scilla nervosa is the most widespread of the southern African scillas and is an important ethnomedicinal plant, although it has long been regarded

which produces isoquinoline alkaloids. However, these were not isolated using this technique.

An investigation of *Dioscorea dregeana* (Dioscoreaceae)

The wild yam, *Dioscorea dregeana* (Kunth) Dur. & Schinz, is one of the most popular Zulu medicinals in trade (Mander, 1998). Over 10 000 tubers of this narcotic plant pass through the Durban medicinal markets each year (Cunningham, 1988). The plant is used in the treatment of nervous complaints, including convulsions, cramp, epilepsy (Pujol, 1993) and alcoholism (Bryant, 1909). The Zulu use the plant to treat cases of delirium or insanity (Gerstner, 1938; Watt and Breyer-Brandwijk, 1962). Watt (1967) considers this plant to induce depression of the central nervous system, resulting in unconsciousness after a sufficiently large dose. The stupefying qualities of the plant have engendered its use as a beer additive. Fresh tubers have been eaten as a famine food by the Zulu, however, the tubers may only be used after they have been soaked in running water or paralysis and narcosis may occur (Gerstner, 1941).

Chemical analysis of the tubers yielded dioscorine, crinamine, sitosterol, stigmasterol, 3,4',5-trihydroxybibenzyl and dodecanosyl 3-(4'-hydroxy-3'-methoxyphenyl)propenoate (Page, 1998). Crinamine is a common isoquinoline alkaloid typical of the Amaryllidaceae family and not known previously to occur outside that family. It is known to act as a respiratory depressant and has been shown to be a powerful transient hypotensive agent in dogs. The LD_{50} value in dogs is 10mg/kg.

Crinamine has been reported from the Amaryllidaceae of southern Africa (Vildomat *et al.*, 1997). This alkaloid is found in two of the three regional amaryllids considered psychotropic, *Ammocharis coranica* (Ker-Gawl.) Herb. (Mason *et al.*, 1955; Koorbanally *et al.*, 2000) and *Brunsvigia radulosa* Herb. (Dry *et al.*, 1958; Loubser and Zietsman, 1994).

Investigations of two Amaryllidaceae species: *Ammocharis coranica* and *Brunsvigia radulosa*

Ammocharis coranica (Ker-Gawl.) Herb. is one of the most widespread amaryllids of the summer-rainfall region of southern Africa. It is known to the Zulu as *incotho* (Hulme, 1954), a vernacular term also applied to *Boophane disticha* (L.f.) Herb. (Amaryllidaceae)(Gerstner, 1938) a well-documented hallucinogen, arrow poison and homicidal agent of the region (Neuwinger, 1994; Viladomat *et al.*, 1997). A healer from the Nongoma District of Zululand reported that *A. coranica* was used as a substitute for *B. disticha* when the latter was unavailable, for the treatment of mentally ill patients. The bulb has further been considered a cure for unspecified afflictions resulting from witchcraft (Hulme, 1954) and (*sensu Ammocharis falcata* Herb.) a useful medicine for cattle (Gerstner, 1938). Across much of its range the outer bulb scales are partially burned in the production of a plastic pitch-like substance which is moulded into traditional headrings for

subscribing to traditional medical care, even in urban areas, a supply crisis confronts traditional healers. Already, a number of ethnomedicinal plants such as *Warburgia salutaris* (Pepper-bark Tree) and *Siphonochilus aethiopicus* (Wild Ginger) have become locally extinct. Overall, 159 of the medicinal plants of southern Africa have been assigned Red Data List (RDL) status (Arnold *et al.*, 2001).

Several research projects will be discussed: firstly, an investigation of two plants, *Ekebergia capensis* and *Clivia miniata*, which are used during pregnancy and childbirth by Zulu women; secondly the investigation of *Dioscorea dregeana*, a narcotic plant used as a beer additive; thirdly, the narcotic amaryllids, *Ammocharis coranica* and *Brunsvigia radulosa*; and fourthly, two widely used hyacinthacs, *Scilla natalensis* and *Scilla nervosa*.

Investigation of plants used during pregnancy and childbirth for uterotonic activity

Ingestion of plant extracts during pregnancy is common practice by black women in KwaZulu-Natal and as many as 57 different plants are used (Veale *et al.*, 1992). Different concoctions (isihlambezo mixtures) are made to either provide supplements that reputedly aid the growth of the foetus or act as uterotonic agents that facilitate or induce labour.

In this investigation, super critical fluid extraction (SCFE), using water-modified carbon dioxide, was directly coupled on-line to a uterotonic bioassay, using guinea pig smooth muscle *in vitro* (Sewram *et al.*, 1998). It was decided to use an on-line approach as it has the potential to combine both sample preparation and analysis and because it has the potential to transfer every extracted analyte molecule to the detection system thereby increasing sensitivity.

Extracted fractions were obtained by sequentially increasing the pressure at constant temperature and modifier concentration in an attempt to find the active fraction. Extractions were performed at 200, 300 and 400atm. In both cases the extracts acquired at 400atm. were found to be the most active and these were collected and compounds present in the extracts were isolated and identified. The *Ekebergia capensis* extract contained five known compounds: ?-sitosterol, oleanonic acid, 3-*epi*oleanolic acid, 2,3,22,23-tetrahydroxy-2,6,10,15,19,23-hexamethyl-6,10,14,18-tetracosatetraene and 7-hydroxy-6-methoxy coumarin. Each of these compounds was re-tested and it was shown that the active constituents were oleanonic acid and 3-*epi*oleanolic acid (Sewram *et al.*, 2000). In the case of *Clivia miniata*, a white precipitate appeared in the muscle bath. GC-MS of this material indicated it to be linoleic acid. Re-testing of this compound indicted it to be the active component.

In both cases the identity of the active compound was surprising. Oleanolic acid and 3-*epi*oleanolic acid are common constituents of plants, and as the plant is a member of the Meliaceae family, known for its production of complex limonoids in its seed, one might have expected a limonoid to be the active ingredient. *Clivia miniata* is a member of the Amaryllidaceae family

INVESTIGATIONS OF ETHNOMEDICINAL PLANTS OF SOUTHERN AFRICA

Dulcie A. Mulholland[1]* and Neil Crouch[2]

[1]Natural Products Research Group, University of Natal, 4041 Durban, South Africa.
[2] Ethnobotany Unit, National Botanical Institute, P.O. Box 52099, 4007 Berea Road, South Africa.

Keywords: Medicinal plants of Southern Africa, *Ammocharis coranica, Brunsvigia radulosa, Clivia miniata, Dioscorea dregeana, Ekebergia capensis, Scilla natalensis, Scilla nervosa.*

INTRODUCTION

Southern Africa is home to a wide diversity of cultural groups, all of which utilize the flora for a variety of purposes, especially in regard to traditional medicine. The region has an extremely rich and diverse flora comprising *ca.* 24 500 taxa making up about 10% of the world's flora. Restricted to South Africa is the Cape Floristic Region with over 6000 endemic species: one of the world's richest floral regions (Cowling and Hilton-Taylor, 1994). A great variation in climate from sub-tropical along the eastern coast, aridity in the west, to the Mediterranean climate of the Western Cape has contributed to the evolution of a wide diversity of plants well adapted to the different habitats.

World-wide, it is estimated that between 14 and 28% of all higher plants are used medicinally, that only 15% of all angiosperms have been investigated chemically, and that about 74% of all pharmacologically active plant-derived components have been discovered following ethnomedical usage leads (Farnsworth and Soejarto, 1991). In southern Africa, approximately 15% of the flora is ethnomedicinal, represented by 215 families, 1 240 genera and 3 689 taxa (Arnold *et al.*, 2001). Many species are endemic to the region. The trade in medicinal plants in Southern Africa is an important part of the economy. Over 700 plant species are reported as being traded in the region (Mander, 1998). The value of trade in medicinal plants in the province of KwaZulu-Natal alone was estimated to be $10 million in 1998 with most households spending between 4 and 8% of their annual income on indigenous medicine services. Additionaly, between 20 000 and 30 000 people in the province derive an income from trading these plant species (Mander, 1998). Apart from local traditional plant usage, taxa such as *Aspalanthus linearis* (Rooibos), *Harpagophytum procumbens* (Devil's Claw) and *Hypoxis hemerocallidea* (African Potato) are exported to the East and Europe.

In South Africa there are *ca.* 27 million indigenous medicine consumers. Such is the demand for raw materials that, when coupled to extensive veld transformation, the medicinal flora of the region is under severe threat of over-exploitation. With over 80% of the population

الحالة الغذائية للزيتون النامى فى أنواع مختلفة من التربه تحت ظروف الزراعة الجافة فى تونس
١ –الحالة الغذائية للزيتون النامى على التربة الرملية

عادل سعد الحسنين* ، محمد مصطفى الفولى** ،على المهيرى*** سمير حسنى أحمد شعبان**
* قسم الموارد الطبيعية – معهد البحوث والدراسات الأفريقية – جامعة القاهرة
** قسم النبات – الشعبة الزراعية – المركز القومى للبحوث – جمهورية مصر العربية
*** قسم علوم الأراضى – المعهد القومى للعلوم الفلاحية – تونس

الملخص

تم إجراء هذه الدراسة أثناء موسمى ١٩٩٦–١٩٩٧ على بساتين أشجار الزيتون النامية على التربة الرملية فى شرق ووسط تونس تحت ظروف الزراعة المطرية وذلك لتقييم الحالة الغذائية لأشجار الزيتون.

بينت النتائج أن مناطق شرق ووسط تونس تحتوى على مستويات غير كافية لمعظم العناصر المغذيـــة الكـــبرى والصغرى وأن نقص العناصر مرتبط ببعض العوامل المؤثرة على إذابتها وإتاحتها وأهمها إرتفاع قيم رقم pH التربة .

من إجمالى عدد العينات التى تم تحليلها: وجدت مستويات العناصر فى الموسم الأول الأقل من المعدل الطبيعى فى أوراق الزيتون للعناصر الكبرى (النتروجين – الفوسفور –البوتاسيوم –الماغنسيوم –الكالسيوم) ٤٤ ، ٧٥ ، ٩٤ ، ١٣ ، ٦ % على التوالى بينما وجدت للعناصر الصغرى (الحديد – المنجنيز – الزنك – النحاس –البـــورون) ١٠٠،١٢،١٠٠، ٥٧ ، ٩% على التوالى وفى الموسم الثانى: وجدت مستويات العناصر الأقل منُ المعدل الطبيعى فى أوراق الزيتون للعناصـــر الكبرى (النتروجين – الفوسفور –البوتاسيوم)٩٨،٧٧،٩٧%على التوالى بينما وجدت مستويات الماغنسيوم والكالسيوم كافية ، أما العناصر الصغرى (الحديد – المنجنيز – الزنك – النحاس) فقد وجدت ٧٢،٩، ٩٨، ٩٢ % على التـــوالى ، بينما البورون كان كافيا فى جميع عينات الأوراق.

REFERENCES

Alison , L . E.and Moodie, C.D.(1965). Carbonate .In: "Methods of Soil Analysis" C.A. Black (ed), pp: 1379 - 1396. Am . Soc. Agron .,Inc., Madison. Wisc. USA .

Ankerman, D. and Large, R.(1974). Soil and plant analysis. Tech. Bull. A & L Agricultural laboratories. Inc., USA.

Aulio K. and Ojala, A.(1983). Selective utilization of copper and zinc in three species of Vaccinium (Ericaceae).J. of Plant Nutrition, 6,177.

Baligar V.C., Nielsen, N.E. and Barrer,S.A.(1979). Kinetics of Absorption of K, Rb and Cs from solution culture by intact plant roots. J. of Plant Nutrition. 1, 25:25-37

Bouat, A. (1968). Physiologie de l,olivier et analyse des feuilles. Informations oleicoles internationals.

Chapman, H. D. and Pratt, P. F. (1978). Methods of analysis for soils, plants and waters, Univ.of California, Dept. of Agric. Sci., USA, 320 P.

Hartmann,H.H.,Uriu,K.and Lilleland,O.(1966).Olive nutrition.In'Nutrition of fruit Crops'. (Ed.N.F.Childers.) PP:252-261.(Hortic.Publs: New Brunswick,N.J.)..

Haselhoff,E., und Blanck, E.(1928).Lehrbuch Agrikulturchemie,II.Borntraeger, Berlin (C.F.:A.Finck,"Fertilizers and fertilization,"Verlag Chemie,PP: 204-205.

Jackson, M. I. (1973).Soil Chemical Analysis .Printice -Hall India.

Jordao, P.V .,Dias, J . C . S .,Calouro, F . and Duarte, M . L. (1994). Effect of fertilization on the leaf macronutrient concentration of olive tree.Acta Horticulturae. 356:197- 201.

Kilmer,V.J. and Alexander, L.T. (1949). Methods of making mechanical analysis of soils. Soil Sci. 68:15-24.

Lindsay, W. L. and Norvell, W. A. (1978). Development of a DTPA micronutrients soil test. Soil.Sci. Society.Amer . J.42: 421- 428.

Ma, T.S. and Zuazage, (1942). Micro - Kjeldahl determination of nitrogen, a new indicator and an improved repid method. Industr. Eng. Chem. Anal. Ed. 14, 280 - 286.

Markaham, R. (1942). A steam distillation apparatus for micro-Kjeldahl analysis. Biochemical J.36 : 790.

Olsen , S. R., Cole , S .V. ,Watanabe , F. S. and Dean , L. A. (1954). . Estimation of available phosphorus in soil by extraction with sodium bicarbonate. U.S. Dept. Agric., Circular No.939: 1-19.

Recalde, L. and Chaves, M. (1975). La fertilisation de l olivier. Seminaire Oleicole International Cordoue (Espagne), 25pp.

Richards,L.A.(1954).Diagnosis and improvement of saline and alkali soils USDA Handbook No.60 Washington, D.C., USA.

Walkley, A.(1947). A critical examination of a rapid method for determining organic carbon in soil. Effect of variations in digestion conditions and of inorganic soil constituents. Soil Sci., 63 : 251 - 264.

Wolf, B. (1971). The determination of boron in soil extracts , plant materials, composts, manure's, water and nutrient solutions . Soil Sci . and Pl. Anal., 2,363.

Comparative micronutrient ratios (Discrimination factor)

According to Baligar *et al.*(1979) and Aulio and Ojala (1983), discrimination factor (Df) of micronutrient pairs for olive leaf samples were calculated for the same locations under sandy soils for seasons 1996 and 1997 and listed in table 8 which reveal the following for the both seasons : Df values were > 1 for Fe /Mn, Fe /Cu and Zn / Cu, while Mn / Zn , Mn /Cu, Mn /B, Zn / B and Cu / B were < 1, except Fe / Zn and Fe / B were , < 1 in the first season and was > 1 in the second season . Accordingly, olive leaves in sandy soils showed Df values in a pattern of Zn > B > Fe > Cu > Mn in the first season , while in the second season showed Df values in a pattern of Fe > B > Zn > Cu > Mn, indicating that olive trees have more ability ((preferability) to take up Zn, B and Fe in more quantities than Cu and Mn under sandy soil conditions.

From the data in the previous table, it could be noticed that the priorities of needs for different elements change from one season to another. Data show that the trend of elements is ranked according to their need and it was the same for B, Cu and Mn in the two seasons of study, except for Fe and Zn, which showed change in the priorities rank in the second season compared with the first season.

Table 8. Discrimination factor (Df) for micronutrients in olive trees of sandy soils, Tunisia, 1996 / 1997.

	1996			1997		
Ratio	Range	Mean	+SD	Range	Mean	+SD
Fe / Mn	8.05 - 12.48	10.34	2.00	5.61 - 25	14.07	7.14
Fe / Zn	0.30 - 0.53	0.38	0.10	0.54 - 7.0	2.72	2.51
Fe / Cu	1.02 - 4.87	2.69	1.39	3.55 - 25.7	10.59	9.73
Fe / B	0.11 - 1.27	0.75	0.42	0.33 - 2.07	1.06	0.68
Mn / Zn	0.02 - 0.07	0.04	0.02	0.04 - 0.48	0.22	0.18
Mn / Cu	0.13 - 0.95	0.37	0.34	0.30 - 0.95	0.65	0.29
Mn / B	0.02 - 0.12	0.08	0.04	0.06 - 0.09	0.07	0.01
Zn / Cu	1.95 - 16.50	10.17	5.77	1.48 - 31.7	8.51	12.98
Zn / B	0.38 - 2.80	1.89	0.92	0.12 - 2.13	0.73	0.80
Cu / B	0.02 - 0.91	0.34	0.36	0.06 - 0.28	0.15	0.09

Acknowledgements:

The authors wish to thank Dr. Brahamm, Olive Institute of Sousse, Tunisia for his sincere help during the field visits. Also, the authors are highly indebted to the Egypto-German Project on Micronutrients and Other Plant Nutrition, Problems, for laboratory facilities which made this work possible.

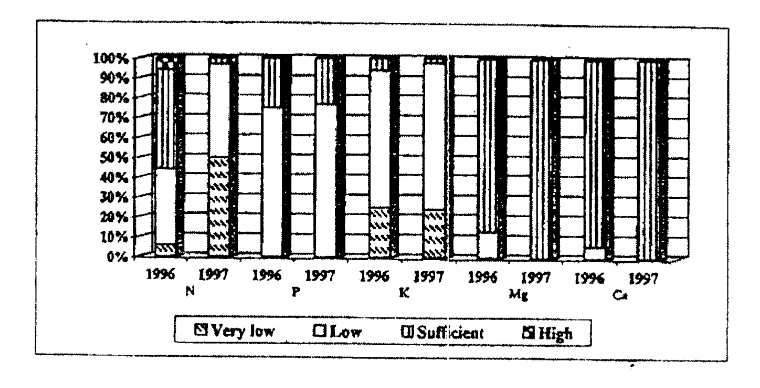


Fig. 1. : Distribution of macronutrients in olive leaf samples (%) based on different levels of nutrient status in sandy soils of Tunisia.

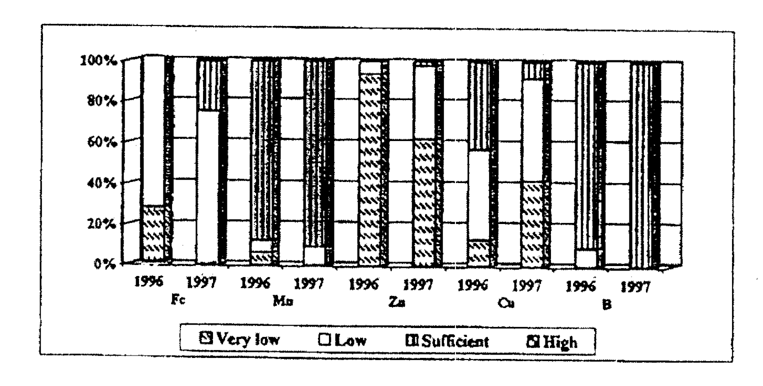


Fig. 2. : Distribution of micronutrients in olive leaf samples (%) based on different levels of nutrient status in sandy soils of Tunisia.

Table 6 Content of leaf nutrients collected from Chemlali olive trees grown on sandy soils in Tunisia 1997.

Area			Sousse					
Element	Safax	Almanister	Kondar	Enfidha	Sidi Buzid	Range	Mean	+SD
%								
N	1.18	1.34	1.07	1.25	0.83	0.83-1.34	1.13	0.20
P	0.09	0.10	0.09	0.09	0.08	0.08-0.10	0.09	0.01
K	0.66	0.70	0.51	0.61	0.61	0.51-0.66	0.62	0.07
Mg	0.41	0.44	0.44	0.40	0.45	0.40-0.45	0.43	0.02
Ca	2.31	2.44	2.50	2.21	2.32	2.21-2.5	2.36	0.11
Na	0.03	0.05	0.04	0.05	0.02	0.01-0.05	0.04	0.01
ppm								
Fe	122.00	97.00	98.00	107.00	103.00	97-122	105.00	10.11
Mn	44.20	46.50	31.60	33.60	25.50	25.5-46.5	36.30	8.80
Zn	11.70	17.20	18.40	14.60	14.80	11.7-18.4	15.30	2.60
Cu	3.20	5.20	3.30	2.70	4.10	2.7-5.2	3.70	0.98
B	26.00	27.00	24.00	23.00	34.00	23 -34	27.00	4.32

Table 7. Sufficient values of macro and microelements for olive leaves.

Element	Values	Element	Values
%		ppm	
N	1.5 - 2.5	Fe	124*
P	0.10 - 0.30	Mn	> 25
K	0.8 - 1.30	Zn	>25
Ca	1.0 - 2.4	Cu	4 - 19
Mg	0.10 - 0.30	B	19 - 150
Na	< 0.2		

Sources :

Haselhoff and Blanck (1928)

Hartmann *et al.* (1966)

Bouat, (1968)

Recalde and Chaves (1975)

*The mean of Fe concentration in the Mediterranean countries, (Bouat, 1968)

Nutritional status of olive leaves:

From data presented in tables 5 and 6 it can be noticed that the mean values of nutrient concentrations for olive leaves in areas of East and Center of Tunisia, were 1.41, 0.09 , 0.77 , 0.24 , 1.18 % for N, P, K, Mg and Ca and were 65 , 30.4 , 12.4 , 7.7 , 25 ppm for Fe, Mn, Zn, Cu and B, respectively in the first season, while in the second season, they were 1.13, 0.09, 0.62, 0.43 and 2.36% for N, P, K, Mg and Ca and were 105, 36.3, 15.3, 3.7 and 27 ppm for Fe, Mn, Zn, Cu and B, respectively. Data show that the trend of element concentrations was the same in the two seasons for P, K, Mn, Zn and B, while there were differences in concentrations of N, Mg, Ca, Fe and Cu for the two seasons. With reference to the tentative olive leaves mentioned in table 7 and depicted in figures 1 and 2, it is evident that nutrient levels in olive leaves of the studied locations below normal were 44, 75, 94, 13, 6 % for N, P, K, Mg and Ca , respectively, and 100 ,12, 100, 57 and 9 % for Fe, Mn, Zn, Cu , and B, respectively in the first season, while in the second season, they were 97, 77, 98 % for N, P, K. On the other hand, both Mg and Ca levels were sufficient and the levels in olive leaves below normal were 72, 9, 98, 92 % for Fe, Mn, Zn and Cu respectively, while B level was sufficient. Also, it is evident from the same Figures that the deficiency of N and Cu in the second season were more than in the first season.

Table 5 • Content of leaf nutrients collected from Chemlali olive trees grown on sandy soils in Tunisia 1996.

Area / Element	Safax	Almanister	Sousse		Sidi Buzid	Range	Mean	+SD
			Kondar	Enfidha				
%								
N	1.43	1.75	1.06	1.45	1.38	1.06-1.75	1.41	0.25
P	0.09	0.10	0.06	0.10	0.09	0.06-0.1	0.09	0.02
K	0.68	0.82	0.72	0.85	0.78	0.68-0.85	0.77	0.07
Mg	0.26	0.21	0.19	0.23	0.31	0.19-0.31	0.24	0.05
Ca	1.29	1.08	1.09	1.11	1.33	1.08-1.33	1.18	0.12
Na	0.01	0.01	0.01	0.01	0.01	0.006-0.009	0.01	0.00
ppm								
Fe	85.00	54 70	53.00	62.00	70.10	53-85	65.00	13.00
Mn	29.50	33 90	35.20	25.90	27.70	25 9-35.2	30.40	4.00
Zn	10.90	11.50	12.30	17.80	9.50	9.5-17.8	12.40	3.20
Cu	8.00	10 70	8.40	9.10	2.40	2.4-10.7	7.70	3 10
B	21.00	21.00	29.00	24.00	29.00	21-29	25.00	4.02

Soil-nutritional status:

It can be observed from data in the same tables as compared with those mentioned in table 4 that the averages of nutrient contents in the soils were under adequacy for total N and available K, Mg, Fe and Zn. Data also shows that P and B ranged between unsatisfactory and satisfactory. Yet, it could be noticed that Ca contents were high and Mn contents were moderate to high. With respect to copper, its contents were between low and high. The above mentioned results revealed that the soils are poor in most nutrient contents which means that olive trees suffer severely from some elements at once.

Table 4. Tentative rating values of soil characteristics and nutrient contents.

Element	Rating *				
	Very low	Low	Medium	High	Very high
$CaCO_3$ %	< 0.5	0.5-2	2.1-8	8.1-30	31-45
Organic matter (O.M), %	<1.0	1.0-2.0	2.1-3	3.1-5	> 5.0
Electric conductivity (E.C)- (ds/m)	< 0.1	0.1-0.2	0.3-0.4	0.5 - 0.7	> 0.7
pH	< 5.8	5.9-6.6	6.7-7.2	7.3-8.5	> 8.5
Macronutrients (mg/100g)					
Nitrogen (N)	< 100	100-300	300-600	600-1000	>1000
Phosphorus (P)	< 0.5	0.5 -1.1	1.2 -2.7	2.8 - 4	>4
Potassium (K)	< 11.7	11.8 -20	21-30	31-47	>47
Magnesium (Mg)	< 11	11.0-29.0	30 - 180	> 180	
Calcium (Ca)	10.0-40	41-90	91-140	141-500	> 500
Micronutrients (ppm)					
Iron (Fe)	< 5.0	5.0-10.0	11.0-16.0	17-25	> 25
Manganese (Mn)	< 5.0	5.0-8.0	9.0-12.0	13-30	>30
Zinc (Zn)	< 0.5	0.5-1.5	1.6-3.0	3.1-8	> 8
Copper (Cu)	< 0.3	0.3-0.8	0.9-1.2	1.3-2.5	> 2.5
Boron (B)	< 0.4	0.4-0.8	0.8-1.2	1.2-2	>2

* Source
Ankerman and Large (1974)
Lindsay and Norvell (1978)

Table 2. Analysis of sandy soil samples for olive tree groves in Tunisia 1996.

Analysis	0-30cm			30-60cm			60-90cm		
	Range	Mean	±SD	Range	Mean	±SD	Range	Mean	±SD
Sand %	66 - 86	74.60	8.53	62 - 86	70.60	9.21	59 - 82	69.20	8.58
Silt %	6 - 17	11.60	4.62	6 - 17	12.00	4.30	2 - 13	9.8	4.55
Clay %	6 - 20	13.8	6.34	8 - 22	17.4	5.59	15 - 28	21	5.48
$CaCO_3$%	2.6 - 11.4	6.22	3.79	4.4 - 14.5	7.64	3.98	6.3 - 15.3	9.1	3.58
OM %	0.48 - 0.77	0.63	0.12	0.37 - 0.70	0.49	0.13	0.23 - 0.56	0.39	0.13
pH	8.25 - 8.55			8.22 - 8.51			8.08 - 8.46		
EC ds/m	0.17 - 0.30	0.21	0.06	0.15 - 0.29	0.21	0.06	0.18 - 0.35	0.24	0.07
Availability mg/100g									
N	16.9 - 26.9	22	4.29	13 - 24.6	17.34	4.70	8.1 - 19.7	13.8	4.64
P	1.10 - 2.44	1.91	0.53	0.87 - 2.04	1.35	0.49	0.24 - 1.33	0.81	0.40
K	4 - 16.5	8.94	4.78	3.5 - 15.5	8.26	4.56	3.9 - 13.5	8.12	3.87
Mg	4.4 - 18	13.52	6.01	8.8 - 18	14.74	4.04	10.8-23.5	17.96	6.17
Ca	151 - 374	243	86	171 - 495	270	129	198 - 662	303	202
Na	6.3 - 10.9	9.07	1.78	7.2 - 14.3	10.7	3.15	8.6 - 21.5	14.1	5.25
ppm									
Fe	2.5 - 8.0	4.32	2.12	2.60 - 4.9	3.76	0.91	2.0 - 4.70	3.0	1.07
Mn	11.8 - 23.7	16.8	4.86	11.25 - 20.9	15.2	3.65	5.34 - 16.7	11.9	4.42
Zn	0.07 - 0.39	0.24	0.14	0.09 - 0.67	0.27	0.23	0.03 - 0.28	0.13	0.11
Cu	0.54 - 2.14	1.27	0.66	0.56 - 1.48	0.91	0.41	0.46 - 1.75	0.83	0.54
B	1.0 - 1.54	1.18	0.21	0.55 - 1.19	0.89	0.31	0.50 - 1.09	0.75	0.22

Table 3. Analysis of sandy soil samples for olive tree groves in Tunisia 1997.

Analysis	0-30cm			30-60cm			60-90cm		
	Range	Mean	±SD	Range	Mean	±SD	Range	Mean	±SD
$CaCO_3$%	2 - 5.3	4.10	1.32	4 - 12.2	6.68	3.24	6.4 - 15.2	8.90	3.82
OM %	0.51 - 0.82	0.71	0.13	0.34 - 0.62	0.49	0.11	0.17 - 0.44	0.31	0.13
pH	7.91 - 8.7			8.27 - 8.72			8.29 - 8.61		
EC ds/m	0.03 - 0.16	0.06	0.06	0.02 - 0.13	0.05	0.05	0.02 - 0.14	0.06	0.05
Availability mg/100g									
N	18 - 29	25.00	4.44	12 - 22	17	4.15	6 - 16	11	4.55
P	0.8 - 3.4	1.9	1.0	1.1 - 2.7	1.8	0.63	0.6 - 2.5	1.6	0.78
K	11.7 - 27.3	17.8	6.72	9.3 - 24.1	15.08	6.60	8.1 - 16.8	12.28	3.94
Mg	10 - 22	17.2	4.87	10 - 22	17.4	5.50	10 - 32	20.2	8.84
Ca	104 - 628	476	213	289 - 669	532	160	226 - 762	587	208
Na	6.7 - 11.5	9.62	2.21	6.10 - 12	9.56	2.24	4.8 - 14.6	11.06	4.22
ppm									
Fe	1.10 - 9.00	5.8	3.39	0.80 - 6.0	4.86	2.87	0.77 - 7.40	4.67	2.9
Mn	8 - 34.5	19.7	11.32	6 - 34.3	18.04	12.04	5.7 - 30.1	16.7	11.84
Zn	0.4 - 1.83	0.98	0.56	0.13 - 1.73	0.83	0.58	0.08 - 1.7	0.82	0.64
Cu	0.67 - 2.98	1.31	0.94	0.63 - 1.4	0.89	0.31	0.20 - 0.73	0.54	0.22
B	0.52 - 1.15	0.90	0.23	0.39 - 1.4	0.78	0.39	0.37 - 0.65	0.54	0.12

60-90 cm depth,revealed that soil locations tended to show a sandy loam to loamy texture. Moreover, sand contents decrease with the soil profile depth, meanwhile, calcium carbonate content generally ranged between moderate to high level and tended to increase with soil profile depth. Soil organic matter percentage in different locations is very low (< 1%)and decreases with soil profile depth, pH values are almost over 7.9. Electrical conductivity values and sodium contents were low, reflecting no salinity problems.

Lindsay and Norvell (1978), whereas data of leaf analysis were evaluated according to criteria mentioned by Haselhoff and Blanck (1928), Hartman *et al.* (1966), Bouat (1968), Recalde and Chaves (1975), except, Fe concentration which was evaluated according to the mean of Fe concentration in the Mediterranean countries (Bouat, 1968).

Calculation of discrimination factor (Df) for metal pairs; comparative element ratios for plant samples and for soils under these plants were calculated as an index of specific nutrient uptake and thus relative nutrient requirements by the plant.

The equation of: Df = Concentration ratio of total nutrient a/nutrient b in leaves / concentration ratio of extractable nutrient a/nutrient b in soil was applied according to Baligar *et al.* (1979) and Aulio and Ojala (1983). Df value>1means plant preference for metal a and Df value<1 means plant preference for metal b.

RESULTS AND DISCUSSION

Field information

It was observed that nitrogen and phosphatic fertilizers are rarely applied and organic manure, potassic as well as micronutrient fertilizers are not used.

Visual diagnosis:

Olive trees in the studied locations reflected different degrees of nutrient disorders, However, severity of prevailing nutrient deficiency symptoms could be ranked as follows: Zn>K>Fe>P>Cu>N

Nutritional status of olive orchards

Soil characteristics :

The major characteristics of the selected studied soils were described as shown in Table 1.

Table (1): Some major characteristics of the soils in East and Middle of Tunisia.

Location	Sand %	Clay %	CaCO %
Tunisia : Sandy soils			
Safax	71 - 80	8 - 15	5 - 7
Almanister	68 - 74	20 - 22	4 - 10
Sousse Enfidha	65 - 67	18 - 24	2 - 15
Kondar	59 - 66	17 - 28	5 - 15
Sidi Buzid	82 - 86	6 - 16	2 - 9

The data showed that soils in East and Middle of Tunisia were light-texured, since the sand percent age ranged between 59-86%. Results presented in tables 2 and 3 show that the studied soils, within 0-30 cm, 30-60 cm and

MATERIALS AND METHODS

Field visits and sampling were carried out during April ,1996 and 1997 from main areas dominated by olives (*Olea europaea L.*) in Center and East of Tunisia.These areas are : Safax - Almanister - Sousse (Kondar - Enfidha) and Sidi Buzid. Field practice information and visual diagnosis of prevailing nutrient deficiency symptoms were recorded. Soil sampling was collected from 0-30 cm, 30-60 cm and 60-90 cm depths, from the active root zones at the end of canopy shadow of the tree. For leaf sampling, leaves were collected from Chemlali variety which is the main prevailing variety in Center and East of Tunisia. Leaves were sampled under natural growth conditions from the middle portion of the previous season. Terminal shoots , lower and apical leaves were discarded (Bouat, 1968). Total of 126 soil and 89 leaf samples were taken .

Composite soil samples were air-dried, ground in a wooden mortar and sieved through 2 mm pores sieve and stored in polyethylene bags for chemical analysis Leaf samples were washed once with tap-water to remove dust and with 0.001 M HCl to dissolve any contaminants, then washed with distilled water .Thereafter, leaf samples were air-dried for 1-2 hr, then dried in a ventilated oven at 70^{o} C for 48 hrs. Dried samples were ground in a stainless steel mill with 0.5 mm sieve.Soil samples were tested for texture by hydrometer (Kilmer and Alexander, 1949), pH and EC in a 1 : 2.5 soil/water suspension (Richards, 1954), total $CaCO_3$ by Collin's calcimeter (Alison and Moodle, 1965) and Organic matter content according to Walkley modified method (1947).Available content of K, Mg and Ca were extracted by NH_4 - AOc (Jackson, 1973), whereas P was extracted by Na HCO_3 (Olsen *et al.*1954), B was extracted using boiling water (Wolf, 1971). Soil available micronutrients (Fe, Mn, Zn, Cu) were extracted using DTPA (Lindsay and Norvell, 1978).

Total content of each of P, K, Mg, Ca and Na as well as Fe, Mn, Zn, and Cu were extracted after dry ashing a sample of 1g in a muffle furnace at 500^{o} C for 6 hr., then the ash was dissolved in concentrated HCl (2N) and diluted with distilled water to 50 ml and filtrated (Chapman and Pratt, 1978),whereas, total N was determined by using micro- Kjeldahl method (Markaham, 1942), using boric acid modification as described by Ma and Zuazage (1942), and distillation was done using Buchi 320-N_2 ,distillation unit and Boron was determined with Azomethine-H (Wolf, 1971).

For both soil and leaf samples,K, Ca and Na were measured using Flame photometer (Jenway, PFP 7). P and B were measured by spectrophotometer (Perkin-Elmer, LKB ultrospec : II) UVNIS- Spectrometer-Lambda 2 using vanado-molybdate color reaction for P and Azomethine - H for B. Fe, Mn, Zn, Cu and Mg were measured by atomic absorption spectrophotometer (Perkin Elemer, 1100) apparatus.

Concentrations of P, K, Ca and Mg were calculated as (%), whereas Fe, Mn, Zn, Cu and B were calculated as (ppm). Data of soil testing were evaluated depending on criteria mentioned by Ankerman and Large (1974),

NUTRITIONAL STATUS OF OLIVES GROWN ON DIFFERENT OILS UNDER DRY FARMING CONDITIONS IN TUNISIA
NUTRITIONAL STATUS OF OLIVES GROWN ON SANDY SOILS

El-Hassanin, A.S*, El-Fouly, M.M**, El-Mhiri, A***, and Shaaban, S.H.A**
*Department of Natural Resources, Institute of African Research & Studies, Cairo Univ.,
**Botany Dept., National Research Centre, Dokki, Egypt
***Department of Soil Science, Institute of National Agriculture of Tunisia

ABSTRACT

This study was carried-out during 1996-1997 seasons on olive orchards, grown on sandy soils under rainfed farming conditions in East and Middle Tunisia to evaluate the nutritional status of olive trees. Inadequate levels of most macro and micronutrients in soils were found. Nutrient deficiencies are conceptually related to some factors affecting their solubility and availability, mainly high pH values. Results of olive leaf analysis revealed that nutrient levels were below normal 44, 75, 94, 13 and 6 % for N, P, K, Mg, and Ca and 100, 12, 100, 57 and 9% for Fe, Mn, Zn, Cu and B, respectively, in the first season, while in the second season they were 97, 77, 98 for N, P, and K. On the other hand, sufficient Mg and Ca levels in leaves were found. The values of micronutrients below normal were 72, 9, 98, 92 % for Fe, Mn, Zn and Cu respectively. Results revealed that B levels were sufficient in all leaf samples.

INTRODUCTION

Olive tree can be grown on a wide range of soil types, where the soils are generally sandy or highly calcareous and subjected to salinity and drought. It is typically grown in arid regions. Most of olive plantations in Tunisia are concentrated at areas of Safax, Almanister, Sousse and Sidi Buzid. In Tunisia there is a need to increase the quantity and value of exports of olive oil to improve the national economy. From the above-mentioned fact there is a great need to increase the vertical production through improving practices. Fertilization has a great influence on the leaf mineral concentration and consequently, fruit yield (Jordao *et al.* 1994). Therefore, the nutritional status of olive trees is among the most important factors which restrict the obtained yield.

دراسات كاريولوجية على بعض الأفراد البرية للفصيلة الصليبية فى مصر

ماجدة إبراهيم سليمان
قسم النبات - كلية العلوم بدمياط - جامعة المنصورة - مصر

الملخص العربى

إستهدف هذا البحث دراسة خلوية لستة أنواع نباتية برية تتبع العائلة الصليبية بمصر وهى : رشاد البحر (*Cakile maritima*) و روف (*Erucaria hispanica*) وداحيان (*Eremobium aegyptiacum*) وشقاره (*Mathiola longipetala*) وحمحم (*M. arabica*) وشمشم (*M. Livida*).

تم دراسة المجموعة الكروموسومية لهذه الأنواع النباتية وشملت تحليل المجموعة الكروموسومية من حيث عدد الكروموسومات ووضع السنترومير والنسبة بين طول الأذرع وكذلك نسبة الـ *TF* والشذوذات الكروموسومية فى الانقسام الميتوزى.

وقد أظهرت الدراسة أن عدد الكروموسومات لبعض الأنواع تسجل لأول مرة مثل *Matthiola arabica* وفيه ٢ ن = ١٤ ، *M. Livida* وفيه ٢ ن = ١٠ ، ١٢ ، *Eremobium aegyptiacum* وفيه ٢ ن = ١٨ ، ٢٠ ، *Erucaria hispanica* ٢ ن = ١٤ .

كذلك وجد أن هناك اختلاف فى المجموعة الكروموسومية من حيث العدد والكاريوتايب بين الأنواع المختلفة لجنس *Matthiola* وكذلك لوحظ إختلافات كروموسومية فى نوع *Cakile maritima* الذى جمع من ثلاث مناطق مختلفة فى مصر بالاضافة الى أن بعض الأنواع تميزت بوجود أكثر من عدد كروموسومى فى نفس الجذر . وقد كشفت الدراسة عن وجود شذوذات كروموسومية تضمنت اللزوجة والجسور الكروموسومية وغيرها فى الانقسام الميتوزى .

Sharma, A.K. and Sikka, K. (1976). Chromosome studies in cruciferae. Res. Bull. Univ. Calcutta (Cytogenetics Lab.) 3: 33-34.

Snoad, B. (1955). Somatic instability of chromosome number in Hymenocallis calathenum. Heredity 9: 129-134.

Soliman, M.I. (1987). Cytogenetic studies in the genus *Matthiola*. Ph.D. Thesis, Leicester Univ., England.

Soliman, M.I. and Parker, P.F. (1986). Chromosome number reports XCIII Taxon 35(3): 610-613.

Stace, C.A. (1980). Plant taxonomy and biosystematics. Arnold, E. Ltd., London.

Stebbins, G.L. (1971). Chromosomal evolution in higher plants E. Arnold Ltd. London.

Strid, A. (1971). Chromosome numbers in some Albanism angiosperms. Bot. Notiser 124: 490-496.

Sveshnikova, I.N. (1927). Karyological studies on *Vicia* Bull. Appl. Bot. and Plant Breed. 17: 37-72.

Tjio, J.H. and Levan, A. (1950). The use of oxyquinoline in chromosome analysis. Anales de la Estac. Exper. De Aula dei 2: 21-64.

Vanloon, J. (1974). A cytological investigation of flowering plants from the canary islands Acta Bot. Neerl. 23: 113-124.

Varaama, A. (1949). Spindle abnormalities and reduction in chromosome number in *Ribes nigrum* Hereditas 35: 136-162.

Ved Brat, S. (1965). Genetic systems in *Allium*. I- Chromosome variation. Chromosoma 16: 486-499.

Vig. B.K. (1968). Spontaneous chromosome abnormalities in roots and pollen mother cells in *Aloe vera* L. Bull. Of the torry Bot. Club. 95(3): 254-261.

Vosa, C.G. (1983). Chromosome evolution in *Ornithogalum* In. Kew chromosome conference II. Brandham, P.D. and Bennett, M.D. (Ed.) George Allen and Unwin: 370.

Guha, S. (1979). Cytological studies in the genus *Amaryllis*. Bull. Bot. Surv. India 21 (1-4): 18-21.

Harberd, D.J. (1972). A contribution to the cytotaxonomy of *Brassica* (Cruciferae) and its allies. Bot. J. Linn. Soc. 65: 1-23.

Harberd, D.J. (1976). Cytotaxonomic studies of Brassica and related genera. In: The biology and chemistry of the Cruciferae by Vaughan, J.G., Macleod, A. J. and Jones, B.M.G. (Eds.) pp 47-68. Academic Press.

Huziwara, Y. (1958). Karyotype analysis in some genera of compositae. IV. The karyotypes within the genera *Gymnaster*, *Kalimeris* and *Heteropappus* Cytologia 23: 33-45.

Huziwara, Y. (1962). Karyotype analysis in some genera of compositae. VIII. Further studies on the chromosomes of *Aster*. Amer. J. Bot. 49: 116-119.

Jadhav, M.G., Birari, S.P. and Mehetre, S.S. (1983). Chromosome numbers and karyotypes of some Australian Grass species. Cytologia 48: 289-292.

Kashyap, S.K. and Mehra, P.N. (1983). Cytological investigations on West Himalayan Orcids. Tribe: Orchideae. 1. The genus *Hebenaria* Wild. Cytologia 48: 633-646.

La Cour, L. (1941). Acetic Orcein. Stain Tech. 16: 169-174.

Larsen, K. and Laggard, S. (1971). Chromosome studies of the Sicilian Flora. Bot. Tidsskr. 66: 249-268.

Levan, A., Fredga, K. and Sandberg, A.A. (1964). Nomenclature for centrometric position on chromosomes. Hereditas, 52: 201-220.

Maassoumi, A.A.R. (1980). Cruciferes de la flora d'Iran. Etude caryosystematique. These, Strasbourg: 1-83.

Madhusoodanan, K.J. and Nazeer, M.A. (1983). Comparative morphology of the somatic karyotypes of vegetable *Amaranthus* and its phylogenetic significance. Cytologia 48: 237-244.

Matthew, M. and Matthew, P.M. (1982). Studies on the South Indian Compositae. III Karyomorphology of nine species of *Blumea* DC. Cytologia 47: 153-162.

Moore, D.M. (1968). The karyotype in Taxonomy. In: Modern methods of plant taxonomy. Heywood, V.H. (Ed.) Academic Press. London and New York, 61-75.

Mulligan, G.A. (1971). Cytotaxonomic studies of *Draba* species of Canada and Alaska: *D. Ventosa*, *D. ruaxes* and *D. paysonii*. Canad. J. Bot. 49: 1455-1460.

Mulligan, G.A. (1974). Cytotaxonomic studies of *Draba nivalis* and its close allies in Canada and Alaska. Canad. J. Bot. 52: 1793-1801.

Ostergren, G. and Frost. S. (1962). Elimination of accessory chromosomes from the roots of *Haplopappus gracilis*. Hereditas 48: 363-366.

Patel, O.P., Singh, C.B., Mishra, R.K. and Gour, V.K. (1983). Karyological studies in *Guizotia abyssinica* coss. Cytologia 48: 221-230.

Pederick, L.A. (1970). Chromosome relationships between *Pinus* species. Silvae Genet. 19: 171-180.

Renzoni, G.C. (1969). *Matthiola tricuspidata* R.Br. (Cruciferae): Analisi Cariologica et embriologica. Giorn. Bot. Ital. 103: 531-545.

Rodman, J.E. (1978). In *IOPB* chromosome number reports LXI. Taxon 27: 375-392.

Sampath, S. (1950). Chromosome diminution in a plant root. Cur. Sci. 19: 185-186.

REFERENCES

Abraham, Z. and Prasad, P.N. (1983). A system of chromosome classification and nomenclature. Cytologia 48: 95-101.

Adhikary, A.K. (1974). Precise determination of centromere locations. Cytologia 39: 11-16.

Al-Shehbaz, I.A. and Al-Omar, M.M. (1982). In IOPB chromosome number reports LXXVI. Taxon 31: 587-589.

Aryavand, A. (1977). In IOPB chromosome number reports LVIII. Taxon 26: 557-565.

Ashraf, M. and Gohil, R.N. (1988). Studies on the cytology of Legumes of Kashmir Himalaya III. Interpopulation differences in the karyotypes of 3 species of *Astragalus* L. Cytologia 53: 543-549.

Battaglia, E. (1955). Chromosome morphology and terminology. Caryologia 8: 179-187.

Bocher, T.W. (1966). Experimental and cytological studies on plant species IX. Some arctic and montane crucifers. K. Denske Videnskabernes Selskab; Biol. Skr.; 14: 7-35.

Brandam, P.E. (1970). Chromosome behaviour in the Aloineae III. Correlations between spontaneous chromatid and sub-chromatid aberrations. Chromosoma (Berl.) 31: 1-17.

Chattopadhyay, D. and Sharma, A.K. (1988). A new technique for orcein banding with acid treatment. Stain technology. Vol. 63, No. 5: 283-287.

Chennaveeraiah, M.S. and Patil, B.C. (1973). Chromosome number and karyotype study in eight species of *Crotalaria*. Cytologia 38: 73-79.

Christopher, J. (1983). Cytology of *Monochoria vaginalis* complex Pres 1. Cytologia 48: 627-631.

Darlington, C.D. and Thomas, P.T. (1941). Morbid mitosis and the activity of the inert chromosomes in *Sorghum* Proc. Roy. Soc. Ser. B 130: 127-150.

Davis, P.H. and Heywood, V.H. (1963). Principles of angiosperm taxonomy. Oliver and Boyd, Edinburgh & London.

Delay, J. and Petit, D. (1971). Littoral Atlantique du Maroc. Inf. Ann. Caryosyst. Et Cytogenet. 5: 1-16.

Elkington, T.T. (1984). Cytogenetic variation in the British flora: Origins and significance. New Phytol. 98: 101-118.

Engelskjon, T. (1979). Chromosome numbers in vascular plants from Norway, including Svalbard. Opera Bot. 52: 1-38.

Favargel, CI. And Goodhue, M. (1977). Cytologie de quelque populations *d'Erysimum* (*grex grandiflorum sylvestre*) d'Italie et France. Bull. Soc., Neuchatel. Sci. Nat. 100: 93-105.

Gadella, T.W.J. and Kliphis, E. (1973). Chromosome numbers of flowering plants in the Netherlands VI. Proc. Kon. Ned. Acad. Wets. Ser. C76: 303-311.

Gill, J.J.B. (1965). Diploids in the genus *Cochlearia* Watsonia, 6: 188-189.

Gill, J.J.B. (1976). Cytogenetic studies in *Cochlearia* L. (Cruciferae). The chromosomal constitution of *C. danica* L. Genetica 46: 115-127.

Gill, J.J.B., McAllister, H.A. and Fearn, G.M. (1978). Cytotaxonomic studies on the *Cochlearia officinalis* L. group from inland stations in Britain, Watsonia 12: 15-21.

MATTHIOLA ARABICA Boiss.

A

MATTHIOLA LIVIDA (Del.) DC.

B



C

MATTHIOLA LONGIPETALA (Vent.) DC

D

Plate 3: Karyograms of : (A) *Matthiola arabica*, (B) *M. livida* (2n = 10), (C) 2n = 12 and (D) *M. longipetala*.

A

B

C

ERUCARIA HISPANICA (L.) Druce

D

E

Plate 2: Karyograms of : (A) *Cakile maritima* (Rashid), (B) Baltim, (C) Alexandria, (D) *Erucaria hispanica* $2n = 14$ and (E) $2n = 16$.

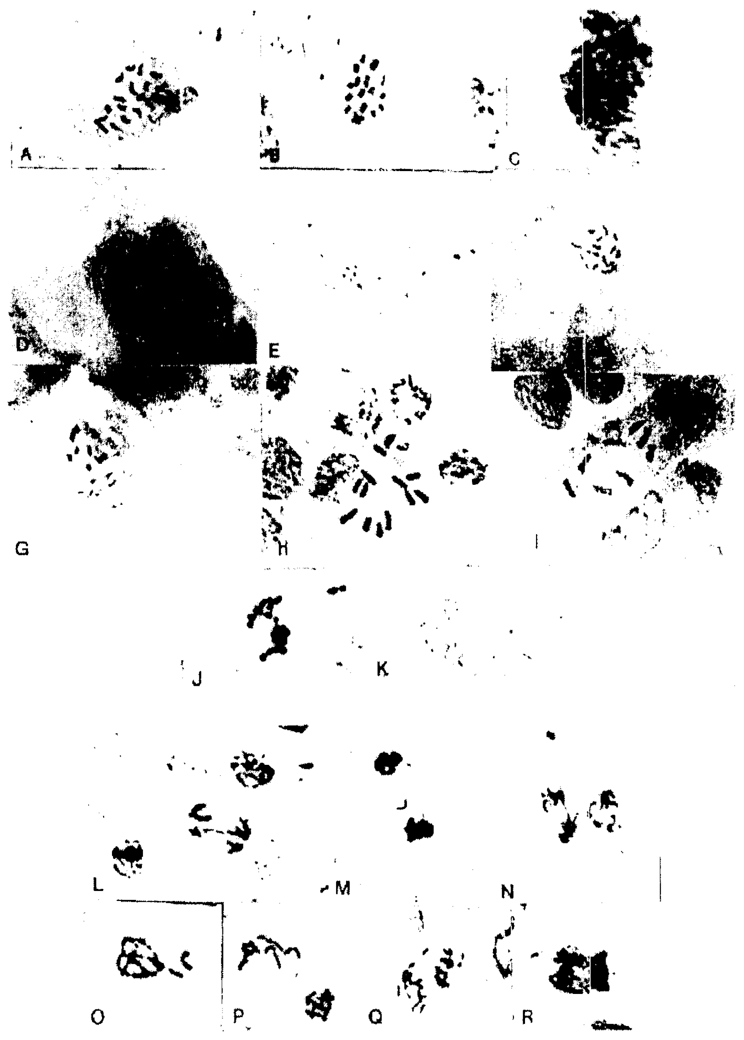


Plate 1: Somatic chromosomes of : (A) *Cakile maritima* (Alexandria), (B) Rashid, (C) Baltim, (D) *Eremobium aegyptiacum* (2n = 18), (E) 2n = 20, (F) *Erucaria hispanica* 2n = 14, (G) 2n = 16, (H) *Mathiola arabica*, (I) *M. livida* (2n = 10), (J) 2n = 12 and (K) *M. longipetala*. (L,N,R) Bridge in anaphase stage, (M, Q) laggard chromosome (O) stickiness and (P) Irregular distribution of chromosomes. (X = 1700).

Table (1): Chromosome data for all the species examined (somatic chromosome number, average size, TF%, total complement length and karyotype formulae).

Taxon	Source	Somatic chromo-some number	Average lenth of chromosome		TF%	Total compl length (?m)	Karyotype formula
			Longest	Shortest			
Cakile maritima	Rashid	2n=18	0.72	0.46	38.02	10.61	6M, 6nm, 6nsm (-)
	Baltim	2n=18	0.90	0.52	35.37	12.70	2M, 8nm, 6nsm(-),2nsm(+)
	Alexandria	2n=18	0.70	0.51	37.20	11.14	2M, 10 nm, 6nsm(-)
Erucaria hispanica	Burg-El Arab	2n=14	0.71	0.46	32.95	8.54	2M, 4nm, 6nsm(-), 2nsm(+)
		2n=16	0.80	0.54	34.23	10.18	2M, 6nm, 6nsm(-), 2nsm(+)
Matthiola arabica	Sant-Kathrin	2n=14	1.15	0.99	31.70	15.00	2M, 4nm, 4nsm(-), 2nsm(+),2nst(-)
M. livida	Cairo-Suez	2n=10	1.29	1.05	35.48	11.77	2M, 4nm, 4nsm(-)
	Desert road	2n=12	1.40	0.51	32.57	11.37	2M, 4nm, 6nsm(-)
M. longipetala	Burg-El Arab	2n=12	1.40	1.12	34.09	15.66	2M, 6nm, 2nsm(-), 2nsm(+)

Table (2): Mitotic abnormalities observed in species of *Matthiola* studied.

Taxon	Total no. of cells examined	Normal cells	% of Abnormalities			
			Bridge	Sticki-ness	Laggards	Irregular distribution of chromosomes
Matthiola arabica	144	138	4.16	-	-	-
M. Livida	132	129	1.52	-	0.75	-
M. longipetala	433	419	0.70	2.08	0.20	0.23

asymmetry is shifting of the centromere from median to sub-median and subterminal position and it has been considered as a progressive step in karyotype evolution. Taxa with asymmetrical karyotype tend to have low TF% (Huziwara, 1962). Therefore, *M. arabica* can be presumed to have more asymmetrical karyotype than the other two species of *Matthiola*. The growth habit of *M. arabica* (perennial) confirms this suggestion since Sveshnikovas'work (1927) on *Vicia* species revealed that in the section Cracca of *Vicia* in which both annuals and perennials occur; the annuals have a more symmetric karyotype than the perennials.

In this study *Matthiola* species showed the mitotic chromatin bridge, irregular distribution of chromosomes, stickiness and laggards. This mitotic irregular chromosome behaviour had been reported in other plants where during the study of karyotype and meiosis of *Aloe vera* (Vig, 1968). Such abnormalities have been known to arise from abnormal metaphase spindle (Varaama, 1949). On the other hand, in study of mitosis in *Aloe aristata* (Brandham, 1970), bridges and fragment were extremely rare but the existence of them at mitosis confirms that some sort (U-type) of chromatid exchanges at meiosis can be due to breakage and reunion between sister chromatids.

between karyotypes of different species of *Pinus* and considered length differences to be due to the accumulation of small duplications. In *Amaranthus*, Madhusoodanan and Nazeer (1983) and in *Hebenari*, Kashyap and Mehra (1983) have shown that variation in chromatin length as well as in the karyotypic formulae is indicative of structural chromosomal alterations in the form of repatterning and chromatic deletions or additions. Ved Brat (1965) reported that inversions have been the main cause for karyotype differentiation in the whole genus *Allium*. Numerous studies have reported that variation in mitotic chromosomes may have originated either by translocation or by pericentric inversions or both: for example: *Crotalaria* (Chennaveeraiah & Patil, 1973), *Blumea* (Mathew and Mathew, 1982), *Ornithogalum* (Vosa, 1983), *Monochoria* (Christopher, 1983), on Australian grass species (Jadhav *et al.*, 1983) and *Guizotia* (Patel *et al.*, 1983). There is therefore a strong probability that similar forces have been operative in *Matthiola*.

Not only do karyotypic variations exist between different species but also within the same species with different base numbers: thus in *Erucaria hispanica* it is obvious that the most conspicuous karyological difference between 16 and 14 cells is the addition of two nearly metacentric chromosomes. Cells with 2n = 16 had 2 metacentric, 6 nearly metacentric, 6 nearly submetacentric (-) and 2 nearly submetacentric (+), while cells having 2n = 14 had 2 metacentric, 4 nearly metacentric, 6 nearly submetacentric (-) and 2 nearly submetacentric (+). The total complement length varied from 10.18 ?m (2n = 16) to 8.54 ?m (2n = 14). In *M. livida* there was an addition of a pair of chromosomes in nearly submetacentric (-) group in the cells with 2n = 12 where they have 2 metacentric, 4 nearly metacentric and 6 nearly submetacentric (-) chromosomes whereas the cells with 10 chromosomes have 2 metacentric, 4 nearly metacentric and 4 nearly submetacentric (-) chromosomes. The total complement length varied from 11.77 ?m to 11.37 ?m. Some chromosomal aberrations that are important tool in bringing about variation in chromosome number may as well play a role in inducing such difference in chromosome morphology.

Also, interpopulation differences were observed among *Cakile maritima* from three different areas. The total complement length varied from 12.70 ?m to 10.61 ?m. With those plants from Rasid showing the lowest value. The karyotype formulae were to some extent different where those specimens from both Rashid and Alexandria were similar in the karyotype classes (three classes) with different chromosome number in each class. Also they were similar in having the longest chromosome being nearly submetacentric (-). Meanwhile, Baltim specimens have four chromosome classes as well as the longest chromosome being nearly metacentric. This karyological differences within different cytotypes of the same species have been observed previously in some species such as *Amaryllis balladonna* (Guha, 1979) and *Astragalus* (Ashraf & Gohil, 1988).

The karyotype formulae of the studied species revealed that all of them had symmetrical karyotype except in *M. arabica* where nearly subtelocentric (-) chromosomes appeared and thus gave the asymmetric affinity. Stebbins (1971) has stated that one of the basic features which bring about karyotype

The cytological features of the three studied species of *Matthiola* showed three basic numbers of n = 5, 6 and 7. Earlier studies of chromosome number of the genus *Matthiola* showed that the majority of the species have n = 6 or 7 (Renzoni, 1969; Larsen and Lagaard, 1971; Sharma and Sikka, 1976; Aryavand, 1977; Maassoumi, 1980 and Soliman and Parker, 1986). *Matthiola arabica* with 2n = 14 and *M. Livida* with 2n = 10 and 12 are reported for the first time in the present study. M. longipetala in the present study has 2n = 12. Most previous records reported 2n = 14 (Aryavand, 1977; Al-Shehbaz and Al-Omar, 1982 & 1983 and Soliman, 1987) whereas Maassoumi, 1980 reported 2n = 12 which is confirmed by this investigation.

Cakile maritima has 2n = 18. This chromosome number had been investigated (Delay and Petit, 1971; Strid, 1971; Gadella and Kliphis, 1973; Vanloon, 1974 and Engelskjon, 1979).

For *Erucaria hispanica* two chromosome numbers were recorded, namely 2n = 14 and 16. The former (2n = 14) is a new record for this species while 2n = 16 was previously reported by Harberd (1972) and Sharma & Sikka (1976).

Eremobium aegyptiacum chracterized by tiny chromosomes had n = 9 and 10 was reported here for the first time. Rodman (1978) found that n = 13 which don't agree with our results. The observed variation in chromosome number as compared to other records may be due to two factors: firstly, different phytochoria and secondly, chromosomal structural alterations that might have taken place during speciation.

Different dibasic chromosome numbers reported in this study in the same root tip has been observed previously in *Sorghum purpeurosericeum* (Darlington and Thomas, 1941); *Haplopappus gracilis* (Ostergren and Frost, 1962), *Oryza* (Sampath, 1950) and in *Hymencollis calathenum* (Snoad, 1955)

Karyotype analysis of the taxa in this study was recorded for the first time except that of *M. longipetala* which has been studied earlier by Soliman (1987) but on Russian and British accessions.

Karyotypic differences was observed between *M. arabica*, *M. livida* and *M. longipetala* with regard to chromosome morphology and chromosome length. The chromosomes of *M. arabica* falls in 5 groups: metacentric, nearly metacentric, nearly submetacentric (-), nearly submetacentric (+) and nearly subtelocentric (-) types whereas *M. livida* had 3 groups of chromosomes: metacentric, nearly metacentric and nearly submetacentric (-) groups. In case of *M. longipetala* the types of chromosomes appeared to be metacentric, nearly metacentric, nearly submetacentric (-) and nearly submetacentric (+). Also the length of chromosomes showed considerable differences where the total complement length varied from 15.66 ?m to 11.37 ?m, with *M. livida* showing the lowest value. Not only the chromosome morphology was variable but also the arm ratio exhibited a considerable variation in *Matthiola* ranging from 4.25 to 1.00. Similar results have been reported in other plant species, Pederick (1970) found differences in the chromosome lengths

were collected from three different localities namely: coastal salt marshes of Burg Rashid, Baltim and Alexandia.

Seeds of the taxa were collected at the fruiting time. Germination at 17-20?C was found to give the highest germination percentage.

Root tips 1-1.5 cm long were collected, pretreated with 0.002 ? 8-hydroxyquinoline (Tjio and Levan, 1950) for 2-4 hours for karyotype analysis. However for the analysis of mitotic chromosomal aberration root tips were not pretreated.

Different staining techniques were tried 2% aceto Orcein (La Cour, 1941) and 2% aceto-Orcein after acid treatment (Chattopadhyay and Sharma, 1988). It was found that aceto-Orcein stain after acid treatment gave the best results.

Well spread metaphase plates were selected and photographed. Karyograms were drawn, length of long arm (L) and short arm (S) were measured for karyotype analysis.

Types of chromosomes were identified and classified according to Abraham and Prasad (1983). The total form percent (TF%) i.e. the average degree of symmetry over the whole karyotype was calculated according to Huziwara (1962).

RESULTS

All the taxa under study are diploid. In the species analysed, 10, 12, 14, 16, 18 and 20 chromosomes are observed in somatic cells (plate 1).

Karyotype analyses include chromosome number, arm ratio, total complement length as well as karyotype formula carried out for all the taxa under study, data summarized in (Table 1). In case of *Eremobium aegyptiacum* the very small apparent size of the chromosomes did not permit a detailed study of their morphology. Karyograms of the species are illustrated in (Plates 2 & 3). The types and proportions of abnormalities observed at mitotic division are summarized and illustrated in (Table 2, plate 1), respectively.

DISCUSSION

Genera and species examined in this study were diploid. No polyploidy were encountered in the different investigated taxa. It is noted that some taxa under study are characterized by more than one chromosome number. This phenomenon is not rare in the family cruciferae since in the genus *Erysimum* which is closely related to the genus *Matthiola* n = 6, 7, 8, 9, 10, 11 and 13 were reported by Favarger and Goodhue (1977). Also Bocher (1966) and Mulligan (1971 and 1974) reported dibasic number of n = 6 and 7 in the genus *Draba*.

INTRODUCTION

Cytological characters, including chromosome number and karyotype analysis have been considered as reliable guides in studies of taxonomic and evolutionary relationships by many authors (Davis and Heywood 1963; Moore 1968 and Stace 1980). A range of examples has been reviewed by Moore (1968), Stace (1980) and Elkington (1984) showing that chromosome studies, especially when combined with hybridization and genetic analysis, have provided essential clues in tracing the origin and the evolutionary history of plant species. The number, size and shape of chromosomes were used to characterize the karyotypes of plants and define the taxonomic differences between them.

In *Cruciferae*, in particular the cytology of a number of genera have been studied in detail, leading to a much clearer understanding of their variation patterns, for example *Cochlearia* (Gill 1965, 1976; Gill *et al.*, 1978), *Brassica* (Stebbins, 1971 and Harberd 1972, 1976) and *Matthiola* (Soliman, 1987).

Chromosome morphology is usually studied on the basis of the position of the primary constriction *centromere* or *kinetochore*) (Battaglia, 1955; Huziwara, 1958; Levan *et al.* 1964 and Adhikary, 1974). A modification of all the previous systems was proposed by Abraham and Prasad (1983). In this system four fixed points and six intermediate regions are recognized in each chromosome segment. Thus according to this last system, the chromosomes can be labelled effectively and it can be successfully used in determining the karyotype more precisely than other systems.

The present study is carried out on some Cruciferous taxa. These are *Cakile maritima* Scop. subsp. *aegyptiaca* (Willd.) Nyman and *Erucaria hispanica* (L.) Druce within tribe Brassiceae, *Eremobium aegyptiacum* (Spreng.) Schweinf. Et Asch. ex Bioss in tribe Hesperideae, *Matthiola arabica* Boiss, *M. Livida* (Del.) DC. and *M. longipetala* (Vent.) DC. In tribe Matthioleae.

The objectives of this work to standardize the cytological analysis of mitotic chromosomes, construct karyotypes of the species and to reveal the types of mitotic irregularities if present and their frequencies.

MATERIALS AND METHODS

All materials used in this study were from natural habitats. For *Matthiola longipetala* and *Erucaria hispanica* the materials were collected from Barley fields of Burg-El-Arab in Alexandria, while *Matthiola livida* and *Eremobium aegyptiacum* from Cairo-Suez desert road, El-Salhia Ismalia and Belbies desert. The specimens of *Matthiola arabica* were collected from rocky mountains in Sant-Kathrin (Sinai). Finally *Cakile maritima* specimens

KARYOLOGICAL STUDIES ON SOME WILD SPECIES OF FAMILY CRUCIFERAE IN EGYPT

Magda Ibrahim Soliman

Botany Department, Faculty of Science (Damietta), Mansoura University, Egypt

ABSTRACT

The present study on some wild taxa belonging to family *Cruciferae* has been carried out from the cyctological view-point. The following species were investigted: *Cakile maritima* collected from Baltim, Rashid and Alexandria, *Eremobium aegyptiacum* from El-Salhia-Ismalia desert road, *Erucaria hispanica* from Alexandria, *Matthiola arabica* from Sinai, *M. livida* from Cairo-Suez desert road and *M. longipetala* from Alexandria.

The somatic chromosome counts for *Matthiola arabica* 2n = 14, *M. livida* 2n = 10 & 12, *Erucaria hispanica* 2n = 14 and *Eremobium aegyptiacum* 2n = 18 & 20 were new reports.

It is evident from the karyotype analyses that the examined taxa had no identical chromosome sets. *Cakile maritima* (2n = 18) collected from Rashid had 6M, 6nm and 6 nsm(-) chromosomes, from Baltim 2M, 8 nm, 6 nsm(-) and 2 nsm(+) chromosomes meanwhile specimens from Alexandria had 2M, 10 nm and 6 nsm(-) chromosomes. *Erucaria hispanica* (2n = 14) had 2M, 4 nm, 6 nsm(-) and 2 nsm(+) chromosomes and (2n = 16) had 2M, 6 nm, 6 nsm(-) and 2 nsm(+) chromosomes. *Matthiola arabica* (2n = 14) had 2M, 4 nm, 4 nsm(-), 2 nsm(+) and 2nst(+) chromosomes. *M. Livida* (2n = 10) had 2M, 4 nm and 4 nsm(-) chromosomes and 2n = 12 had 2M, 4 nm and 6 nsm(-) chromosomes. Finally *M. longipetala* (2n = 12) had 2M, 6 nm, 2 nsm(-) and 2 nsm(+) chromosomes.

The present studied taxa shows that the total complement length was the highest in *Matthiola longipetala* (15.66 ?m) and the lowest in *Erucaria hispanica*, 2n = 14 (8.54 ?m). The arm ratio ranged from 4.25 to 1.00. From the karyotype formulae of the studied species, it was revealed that all of them had symmetrical karyotype except in *Matthiola arabica* where nst(-) chromosomes appeared and consequently showed affinity to asymmetry. With regard to the growth habit of the genus *Matthiola*, it is also evident that the perennial species had low TF% and asymmetric karyotype.

Chromosomal aberrations were observed in mitotic division. Only *Matthiola* species in this study showed the mitotic chromatin bridge, irregular distribution of chromosomes, laggards and stickiness.

The present work may throw the light on the possibility of using the studied taxa as a natural genetic resources which is broadly used today in the field of conservation biology.

BIBILIOGRAPHY

ALI M.I., 1977. On the fungal flora of Saudi Arabia I. Wadi Hanifa. Bulletin of the Faculty ofScience, Riyad University 8: 7-18.

BEYMA F.H. Thoe Kingma van, 1933 a. Beschreibung emiger neuer Pilzarten des Centraalbureau voor Schimmelcultures. Zentralblatt fur Bakteriologie, Parasitenkunde, Jnftctionskrankheiten und Hygiene. II Bbt. 88:132-141.

BEYMA F.H. Thoe Kingma van, 1933b. Beschreibung emiger neuer Pilzarten des Centraalbureau voor Schimmelcultures. II. Zentralblattftur Bakteriologie, Parasitenkunde, Jnfectionskrankheiten und Hygiene. II Bbt. 89: 236-243.

EL-ABYAD M.S., 1997. Biodiversity of Fungal Biota in Egpyt. Up-dated check-list. In : Habitat Diversity, ed. M. Kassas, Publication number 1, National Biodiversity Unit, Egyptian Environmental Affairs Agency 7:1 - 113.

EL-BUNI AM. & S.S. Rattan, 1981. Check-list of Libyan Fungi. Al Faateh University, Faculty of Science, Department of Botany, Tripoli, Libya, 169 pp.

JOHNSTON A. & C. BOOTH (Eds.), 1983. Plant Pathologist's Pocketbook. 2nd ed. CAB International, UK, 739 pp.

MOUBASHER A.H., 1993. Soilfungi of Qatar and other Arab Countries. The Scientific and Applied Research Centre, University of Qatar, 566 pp.

MOUCHACCA J., 1995. Check-list of novel fungi from the Middle East described mainly from soil since 1930. Sydowia 47: 240-257.

MOUCHACCA J., 1997. Thermophilic fungi: Biodiversity and taxonomic reappraisal. Cryptogamie, Mycologie 18:19-69.

MOUCHACCA J., 1999a. Thermophilic fungi: present taxonomic concepts. In Thermophilic Moulds in Biotechnology, eds. B.N. John, T. Satyanarayana & J. Olsen, pp.43-83. Dordrecht/Boston/London: Kluwer Academic Publishers.

MOUCHACCA J., 1999b. A list of novel fungi described from the Middle East, mostly from non-soil substrata. Nova Hedwigia 68:149-174.

MOUCHACCA J., 2001. Biodiversite' des recentes de'couvertes fongiques, dans les e'tats andes de 1' est me' diterrane' en. Bocconea 13:131 - 143.

MOUSTAFA AF., 1975. A preliminary annotated list of fungi from Kuwait. Journal of the University ofKuwait (Science) 2: 67-88.

MOUSTAFA AF., 1978. A supplementary annotated list of fungi of Kuwait. Journal of the University ofKuwait (Science) 5: 61-82.

REICHERT I., 1921. Die Pilzflora Aegypten. Engler's Botanischen Jahrbuchern 56: 595-727.

SABET Y.S., 1935. A preliminary study of Egyptian soil fungi. Bulletin of the Faculty ofScience, Egyptian University, Cairo (Imp. MISR S.A.E.) 5:1-29.

SABET Y.S., 1939. On some fungi isolated from soil in Egypt. Bulletin of the Faculty ofScience, Fouadl University, Egyptian University, Cairo 19:1-112.

Tab. 7. Thermophilc, thermotolerant and/or osmophilic fungi.

THERMOPHILE

scomycetes
Chaetomium mesopotamicum Abdullah & Zora 1993
Coonemeria aegyptiaca (Ueda & Udagawa) Mouchacca 1997
Melanocarpus thermophilus (Abdullah & Al-Bader) Guarro *et al.* 1996

deuteromycetes
Humicola hyalothermophila Moubasher *et al.* 1979
Thermophymatospora fibuligera Udagawa *et al.* 1986

THERMOTOLERANT

ascomycetes
Chaetomiopsis dinae Mustafa & Abdel-Wahid 1990
Chaetomium subcurvisporum Abdullah &Al-Bader 1989
Emericella desertorum Samson & Mouchacca 1975
Emericella omanensis Y.Horie & Udagawa 1996
Emericella similis Y.Horie *et al.* 1990
Monascus pallens Cannon *et al.* 1995
Monascus sanguineus Cannon *et al.* 1995
Rhexothecium globosum Samson & Mouchacca 1975
Talaromyces trachyspermus var. *assiutensis* (Samson & A.-Fattah) Yaguchi & Udagawa 1994
Thielavia aegyptiaca Mustafa & Abdel-Wahid 1990
Thielavia arenaria Mouchacca 1973
Thielavia microspora Mouchacca 1973
Thielavia subthermophila Mouchacca 1973

deuteromycetes
Cladorrhinum bulbillosum W.Gams & Mouchacca 1993
Desertella globilifera Mouchacca 1979
Gilmaniella macrospora Mustafa 1975

XEROTOLERANT

ascomycetes
Eurotium xerophilicum Samson & Mouchacca ;

OSMOTHERMOTOLERANT

deuteromycetes
Aspergillus egyptiacus Moubasher & Mustafa;
Aspergillus peyronelii Sappa (= *A. floriformis* Samson & Mouchacca 1975)

Agaricus meleagris Genevier var. fibrillosus Avizohar-Herschenzon 1961
Oidium arachidis Chorin 1961
Peronospora trifoliicherleri Rayss 1961
Peronospora trifoliiclypeati Rayss 1961
Peronospora trifoliiformosi Rayss 1961
Peronospora trifoliipilularis Rayss 1961
Peronospora trifoliipurpurei Rayss 1961
Adlerocystis parkeri Feldman-Muhsam & Havivi 1963
Adlerocystis ornithodori Feldman-Muhsam & Havivi 1963
Fusariella huguesa Chabelska-Frydman 1964
Sclerophthora lolii R.G. Kenneth 1964
Sclerophthora rayssiae R.G. Kenneth, Koltin & Wahl 1964
Caenothyrium citri Reichert & Chorin 1965
Uromyces christensenii Anikster & Wahl 1966
Uromyces oliveirae Anikster & Wahl 1966
Uromyces rayssii Anikster & Wahl 1966
Uromyces reichertii Anikster & Wahl 1966
Uromyces viennotbourginii Anikster & Wahl 1966
Macowanites galileensis Moser, Binjamini & Avizohar-Hershenzon 1977
Russula carmelensis Moser, Binyamini & Avizohar-Hershenzon 1977
Entomophthora turbinata Kenneth 1977
Clavispora lusitaniae Rodrigues de Miranda 1979
Erynia erinacea (Ben-Ze'ev & Kenneth) Remaud.&Henn. (= Zoophthora erinacea Ben-Ze'ev & Ken. 1979).
Erynia orientalis (Ben-Ze'ev & Kenneth) Humber, Ben-Ze'ev & Kenneth (= Zoophthora orientalis B.Z.& K. 1981)
Entyloma taraxaci K. Vanky 1983
Entomophthora israelensis Ben-Ze'ev & Zelig 1984
Chaetomium dreyfussii J.A. von Arx, in von Arx, Guarro & Figueras 1986
Chaetomium oblatum M. Dreyfuss & J.A. von Arx, in von Arx, Guarro & Figueras 1986
Uromyces scillarum (Baxter) Winter f.sp. *pancratii* Anikster 1987
Fusarium oxysporum f.sp. *heliotropii* D. Netzer & C. Weintal 1987
Spaheropsis sapinea (= Diplodia pinea f.sp. cupressi Solel *et al.* 1987)
Leptosphaeria pimpinellae Lowen & Sivanesan 1989
Microascus desmosporus var. macroperithecia Sage, Steiman, Seigle-Mur. & Guiraud. 1995
Microascus dimorphus Sage, Steiman, Seigle-Mur. & Guiraud 1995
Microascus trigonosporus var. macroperithecia Sage, Steiman, Seigle-Mur. & Guiraud 1995
Agaricus bonei Wasser 1995
Agaricus nevoi Wasser 1995
Aspergillus homomorphus Steiman, Guiraud, Sage & Seigle-Mur. 1995
Aspergillus pseudo-heteromorphus Steiman, Guiraud, Sage & Seigle-Mur. 1995
Bipolaris israeli Steiman, Guiraud, Seigle-Murandi & Sage 1996
Agaricus herinkii Wasser 1996

Rhexothecium globosum Samson & Mouchacca 1975
Ascobolus egyptiacus Mouchacca 1977
Embellisia didymospora Munt.-Cvetkovic (= Ulocladium microsporum Moubasher & Abdel-Hafez 1977)
Talaromyces trachyspermus var. *assiutensis* (Samson & Abdel-Fattah) Yaguchi & Udagawa
(= Talaromyces assiutensis Samson & Abdel-Fattah 1978)
Desertella globulifera Mouchacca 1979
Achaetomium strumarium (= Achaetomium cristalliferum Faurel & Locquin-Linard 1980)
Eupenicillium sinaicum Udagawa & Ueda 1982.
Coonemeria aegyptiaca (Ueda & Udagawa) Mouchacca
(= Thermoascus aegyptiacus Ueda & Udagawa 1983)
Exserohilum oryzinum A. Sivanesan 1984
Lasiobolidium aegyptiacum Moustafa & Ezz El-Din 1989
Chaetomium sinaiense Moustafa & Ezz El-Din 1989
Gilmaniella multiporosa Moustafa & Ezz El-Din 1989
Penicillium allii M.A. Vincent & J.I. Pitt 1989
Setosporella mahmoudii Moustafa & Abdel-Wahid 1989
Mucobasispora tarikii Moustafa & Abdul-Wahid 1990
Scopulariopsis hanii Moustafa & Abdul-Wahid 1990
Trichocladium ismailiense Moustafa & Ezz-El-Din 1990
Thielavia aegyptiaca Moustafa & Abdul-Wahid 1990
Chaetomiopsis dinae Moustafa & Abdul-Wahid 1990
Trichosporon pharoni Ahmed, Ghanem & Reffaat 1992
Cladorrhinum bulbillosum W. Gams & Mouchacca 1993
Cladorrhinum phialophoroides Mouchacca & W. Gams 1993
Gelasinospora hippopotama Krug, Khan & Jeng 1994

PALESTINE-ISRAEL

Oidium matthiolae Rayss 1940
Synchytrium helianthemum Karling (= Synchytrium aureum Rayss 1942)
Urophlyctis astomae Rayss 1942
Urophlyctis eryngii Rayss 1942
Phaeoramularia dissiliens (Duby) Deighton (= Cercospora judaica Rayss 1943)
Phyllosticta fusiformis Nicolas & Aggéry (= Phyllosticta fusiformis f. microcarpa Rayss 1943)
Cytosporina crataegi Allescher (= Cytosporina crataegi f. obesispora Rayss 1943)
Septoria koeleriae Cocconi & Morini (= Septoria koeleriae var. macrocarpa Rayss 1943)
Septoria urticaepiluliferae Rayss 1943
Ustilago jehudana Zundel 1944
Peronospora veronicaecymbulariae Rayss 1945
Actinomucor elegans (= Actinomucor corymbosus f. palaestina Rayss 1946)
Peronospora medicaginisorbicularis Rayss 1946
Peronospora rumicisrosei Rayss 1946
Saccobolus kerverni (Crouan) Boud. f. minor Rayss 1947
Rhizoctonia bataticola (Taubenh.) Butler (= Sclerotium bataticola ssp. intermedium Reichert & Hellinger 1947)
Rhizoctonia bataticola (Taubenh.) Butler (= Sclerotium bataticola ssp. sesamica Reichert & Hellinger 1947)
Rhizoctonia bataticola (Taubenh.) Butler (= Sclerotium bataticola ssp. bataticola Reichert & Hellinger 1947)
Cercospora cephalariae Rayss 1950
Septoria erodii Rayss 1950
Rhopalomyces elegans var. minor (Rayss) Ellis (= Rhopalomyces elegans f. minor Rayss 1950).
Puccinia rimosa f. nattrassii Rayss 1951
Uromyces anthyllidis f. trigonellae Rayss 1951
Entyloma ambrosiaemaritimae Rayss 1952
Entyloma parietariae Rayss 1952
Sphaerulina serograpta var. *calliprinos* Rayss 1953
Cercosporina hierosolymitana Rayss 1955
Cercospora rhagadioli Bubak (= Cercospora rhagadioli var. palestina Rayss 1955)
Septoria withaniae Rayss 1955
Puccinia crucianellae Desm. var. *crucianellaemacrostachyae* Petrak 1957
Periconia pycnospora Fresen. f. israelitica Rayss & Borut 1958
Thielavia terricola (= Thielavia terricola f. minor Rayss & Borut 1958
Uromyces poae Rabenh. f. sp. *asiaticihackelii* Rayss & Chabelska 1958
Crepidotus variabilis var. *stercorarius* Reichert & Avizohar-Herschenzon 1959
Lepista sordida (Fr.) Singer var. gracilis Reichert & Avizohar-Herschenzon 1959
Tricholoma weizianum Reichert & Avizohar-Herschenzon 1959

IRAK

Ascochytella thymi Petrak 1941
Aecidium tami Z. Urban 1966
Uredo fragrantissima Z. Urban 1966
Uromyces acnatholimonis Sydow var. *zagrosica* Z. Urban 1966
Puccinia hadacii Z. Urban 1966
Galzinia cystidiata Rattan & Abdullah 1976 (1977)
Iodophanus basraneous Abdullah, Ismail & Rattan 1977
Hyphoderma puberis var. *dactyliferum* Rattan & Al-Dboon 1980
Stachybotrys guttulispora Muhsin & El-Helfi 1981
Strattonia mesopotamica Abdullah 1983
Trichurus dendrocephalus Udagawa, Y. Horie & Abdullah 1985
Podospora euphratica Abdullah 1987
Thermophymatospora fibuligera Udagawa, Awao & Abdullah 1986
Chaetomium subcurvisporum Abdullah & Al-Bader 1989
Emericella similis Y.Horie, Udagawa, Abdullah & Al-Bader 1990
Melanocarpus thermophilus (Abdullah & Al-Bader) Guarro *et al.*
(= Thielavia minuta var. thermophila Abdullah & Al-Bader 1992)
Exserohilum curvisporum Sivanesan, Abdullah & Abbas 1993
Chaetomium mesopotamicum Abdullah & Zora 1993
Arxiomyces zubairiensis Abdullah & Al-Saadoon 1994
Sphaerodes irakuiensis Abdullah & Abbas 1994
Syspastospora tetraspora Abdullah & Al-Saadoon 1994
Monascus pallens Cannon, Abdullah & Abbas 1995
Monascus sanguineus Cannon, Abdullah & Abbas 1995
Zopfiella cephalothecoidea Guarro, Abdullah, Al-Saadoon & Gené 1996
Zopfiella submersa Guarro, Al-Saadoo, Gené & Abdullah - 1997
Preussia aquilirostrata Guarro *et al.* 1997
Preussia constricta Guarro, Al-Saadoon & Abdullah 1997
Preussia hexaphragmia Guarro, Al-Saadoon & Abdullah 1997
Corynascella arabica Guarro, Al-Saadoo, Gené & Abdullah - 1997

EGYPT

Rhizophydium racemosum Gaertner 1954
Botrytis septospora El-Helaly, Elarosi, Assawah & Kilani 1962
Harpophora maydis (Samra *et al.*) W.Gams
(= Cephalosporium maydis Samra, Sabet & Hingorani 1963)
Aspergillus flaschentraegeri Stolk 1964
Geotrichum candidum (= Geotrichum novakii El-Masry & Zsolt 1966)
Chaetomium gelasinosporum Aue & E.Müller 1967
Chaetomium uniporum Aue & E.Müller 1967
Chaetomium mareoticum Besada & Yusef 1968 (1970 ?)
Alternaria macrospora A. Zimmerman [= Macrosporium macrosporum (A. Zimmerman) Morsy 1969]
Zygopleurage faiyumensis N. Lundqvist 1969
Podospora aegyptiaca N. Lundqvist 1970
Alternaria mouchaccae E.G. Simmons (*nom. nov.*: Ulocladium chlamydosporum Mouchacca 1971)
Pseudeurotium desertorum Mouchacca 1971
Aspergillus egyptiacus Moubasher & Moustafa 1972
Idriella desertorum Mouchacca 1972
Fusariella aegyptiaca Mouchacca 1973
Alternaria chlamydospora Mouchacca 1973
Bipolaris subpapendorfii (Mouchacca) J. Alcorn (= Drechslera subpapendorfii Mouchacca 1973)
Gymnoascus desertorum (Moustafa) von Arx. (= Arachniotus desertorum Moustafa 1973)
Thielavia arenaria Mouchacca 1973
Thielavia microspora Mouchacca 1973
Thielavia subthermophila Mouchacca 1973
Zopfiella karachiensis (Ahmed & Asad) Guarro (= Podospora faurelii Mouchacca 1973)
Arnium bellum Lundqvist 1974
Aspergillus peyronelii Sappa (= Aspergillus floriformis Samson & Mouchacca 1975)
Aspergillus ustus var. *pseudodeflectus* (Samson & Mouchacca) Kozakiewicz
(= Aspergillus pseudodeflectus Samson & Mouchacca 1975)
Emericella desertorum Samson & Mouchacca 1975
Emericella purpurea Samson & Mouchacca 1975
Eurotium xerophilicum Samson & Mouchacca. 1975

Tab. 6. Distribution of taxa following localities of origin and dates of publication (invalid taxa are underlined)

Taxon	Locality
Cercospora saudii M.S. Mohammed 1988	**SAUDI ARABIA**
Ramichloridium mackenziei C.K. Campbell & Al-Hedaithy 1993	
Alternaria selini E.G. Simmons 1995	
Coniochaeta nodulisporioides D. Hawksworth 1978	**JORDAN**
Cylindrotrichum gorii Lunghini 1979	
Humicola hyalothermophila Moubasher, Mazen & Abdel-Hafez 1979	
Chaetomidium khodense Cano, Guarro & ElShafie 1993	**OMAN**
Coprotus dhofarensis Gené, ElShafie & Guarro 1993	
Thecotheus harasisus Gené, ElShafie & Guarro 1993	
Emericella omanensis Y. Horie & Udagawa 1996	
Nematoctonus tripolitanus Giuma & R.C. Cooke 1972	**LYBIA**
Laboulbenia feliciscaprae W. Rossi 1974	
Saccobolus parvisporus van Brummelen 1976	
Saccobolus purpureus van Brummelen 1976	
Exserohilum gedarefense (ElShafie) J. Alcorn 1983	**SUDAN**
Setosphaeria khartoumensis ElShafie & J. Webster 1981	
Chaetosphaeria anglica J. Fisher & O. Petrini 1983	
Plagiosphaera nilotica M. Monod & J. Fisher 1983	
Stigmatomyces ligabuei W. Rossi 1984 (1986)	
Ascitrocystis hughesii Laessoe & Spooner 1994	
Pseudoallescheria desertorum (v. Arx & Moustafa) Mac Ginnis *et al.* 1988	**KUWAIT**
Gilmaniella macrospora Moustafa 1975	
Hyalocladium moubasherii Moustafa 1976	
Thielavia coactilis Nicot (= Thielavia kuwaitensis Moustafa 1976)	
Sporothrix ranii Moustafa 1981	
Cirrenalia basiminuta Raghu-Kumar & Zainal 1988	
Chrysosporium zonatum Al-Musallam & C.S. Tan 1989	
Ascochyta pisi Libert (= Ascochyta orobi f. macrocarpa Rayss 1946)	**LEBANON**
Erysiphe cruciferarum Opiz ex Junell (= Erysiphe communis f. fibigiae Rayss 1946)	
Steganosporium centaureae Rayss 1946	
Guignardia euphorbiae Rayss 1946	
Didymella syriaca Petrak 1947	
Pestalotia insueta Petrak 1947	
Phoma syriaca (Petrak) Boerema *et al.* (= Plenodomus syriacus Petrak 1947)	
Neobroomella ciliata Petrak 1947	
Thryptospora singularis Petrak 1947	
Pythium orthogonon Ahrens 1971	
Tilletia sphenopodis Rayss 1946	**SYRIA**
Aspergillus subsessilis Raper & Fennell (= Aspergillus kassunensis Baghdadi 1968)	
Penicillium chrysogenum Thom (= Penicillium harmonense Baghdadi 1968)	
Penicillium cremeogriseum Chalabuda (= Penicillium yarmokense Baghdadi 1968)	
Penicillium decumbens Thom (= Penicillium arabicum Baghdadi 1968)	
Penicillium dierckxii Biourge (= Penicillium benbitarianum Baghdadi 1968)	
Penicillium manginii Duché & Heim (= Penicillium syriacum Baghdadi 1968)	
Penicillium moldavicum Milko & Beliakova (= Penicillium kabunicum Baghdadi 1968)	
Penicillium quercetorum Baghdadi 1968	
Penicillium simplicissimum (Oudem.) Thom (= Penicillium es-suveidense Baghdadi 1968)	
Penicillium sizovae Baghdadi 1968	
Penicillium steckii Zaleski (= Penicillium baradicum Baghdadi 1968)	
Penicillium westlingii Zaleski (= Penicillium gorlenkoanum Baghdadi 1968)	
Penicillium westlingii Zaleski (= Penicillium damascenum Baghdadi 1968)	

Tab. 5. Distribution of genera following substrate types and localities of origin.

PLANT		SOIL		OTHERS	
		ASCOMYCETES			
Arxiomyces	IR	Achaetomium	EG	Arnium	EG
Astrocystis	SU	Ascobolus	EG	Chaetomidium	OM
Caenothyrium	PI	Chaetomiopsis*	EG	Chaetomium	PI
Chaetomium	PI	Chaetomium (6)	EG, IR	Coprotus	OM
Chaetosphaeria	SU	Coniochaeta	JO	Corynascella	IR
Clavispora *	PI	Coonemeria	IR	Iodophanus	IR
Didymella	LE	Emericella (4)	EG,OM,IR	Laboulbenia	LY
Erysiphe	LE	Eupenicillium	EG	Podospora (2)	EG, IR
Gaucmannomyces	EG	Eurotium	EG	Preussia (2)	IR
Guignardia	LE	Gelasinospora	EG	Saccobolus (3)	PI, LY
Leptosphaeria	PI	Gymnoascus	EG	Stigmatomyces	LY
Neobroomella *	LE	Lasiobolidium	EG	Strattonia	IR
Plagiosphaera	SU	Melanocarpus	IR	Thecotheus	OM
Preussia	IR	Microascus (3)	PI	Zygopleurage	EG
Setosphaeria	IR	Monascus (2)	IR		
Sphaerulina	IR	Pseudoallescheria	KU		
Syspastospora	IR	Pseudeurotium	EG		
Thryptospora	LE	Rhexothecium *	EG		
Zopfiella	IR	Sphaerodes	IR		
		Talaromyces	EG		
		Thielavia (6)	EG, PI, KU		
		Zopfiella	EG		
		DEUTEROMYCETES			
Alternaria (2)	EG, SA	Alternaria (2)	EG	Aspergillus	EG
Ascochyta	LE	Aspergillus(6)	EG,SY,PI	Chrysosporium	KU
Ascochytella	IR	Bipolaris (2)	PI, EG	Cirrenalia	KU
Botrytis	EG	Cladorrhinum (2)	EG	Hyalocladium *	KU
Cercospora (3)	PI, SA	Desertella *	EG	Nematoctonus	LY
Cercosporina	PI	Embellisia	EG	Ramichloridium	SA
Cylindrotrichum	JO	Fusariella	EG	Stachybotrys	IR
Cytosporina	PI	Gilmaniella (2)	EG	Trichosporon	EG
Exserohilum(3)	IR,SU,EG	Humicola	JO		
Fusariella	PI	Idriella	EG		
Fusarium	PI	Mucobasispora *	EG		
Geotrichum	EG	Penicillium (12)	SY		
Oidium (2)	PI	Periconia	PI		
Penicillium	EG	Scopulariopsis	EG		
Pestalotia	LE	Setosporella*	EG		
Phaeoramularia	PI	Sporothrix	KU		
Phoma	LE	Thermophymatospora*	IR		
Phyllosticta	PI	Trichocladium	EG		
Septoria (4)	PI	Trichurus	IR		
Sphaeropsis	PI				
Stegonsporium	LE				
		BASIDIOMYCETES			
Aecidium	IR	Agaricus (4)	PI	Crepidotus	PI
Entyloma (3)	PI	Russula	PI		
Galzinia	IR	Tricholoma	PI		
Hyphoderma	IR				
Lepista	PI				
Macowanites	PI				
Puccinia (3)	PI, IR				
Tilletia	SY				
Uredo	IR				
Uromyces (9)	IR, PI				
Ustilago	PI				

* genus new to sceince
( ) number of species/genus

Tab. 2. Localities of origin and taxonomic divisions (TD).

TD/State	SA	JO	OM	LY	SU	KU	LE	SY	IR	EG	PI	T	(%)
Chytridiomycetes	-	-	-	-	-	-	-	-	-	1	3	4	1,91
Zygomycetes	-	-	-	-	-	-	-	-	-	-	8	8	3,83
Oomycetes	-	-	-	-	-	-	1	-	-	-	10	11	5,26
Ascomycetes	-	1	4	3	5	2	5	-	18	27	11	76	36,37
deuteromycetes	3	2	-	1	1	5	4	13	5	24	19	77	36,85
Basidiomycetes	-	-	-	-	-	-	-	1	6	-	23	30	14,35
Agonomycetes	-	-	-	-	-	-	-	-	-	-	3	3	1,43
Total/State	3	3	4	4	6	7	10	14	29	52	77	209	

For state abbreviations, see Tab. 1. ; T: = Total

Tab. 3. Taxonomic divisions (TD) and substrate types (ST).

TD / ST		Plant	Soil	Other	Total
Chytridiomycetes	(3)	3	1	-	4
Zygomycetes	(5)	-	1	7	8
Oomycetes	(3)	11	-	-	11
Ascomycetes	(51)	20	38	18	76
deuteromycetes	(44)	30	40	7	77
Basidiomycetes	(15)	21	8	1	30
Agonomycetes	(1)	3	-	-	3
Total	(122)	88	88	33	209

Figures between ( ) correspond to number of genera represented

Tab. 4. New genera introduced (in chronological order).

Neobroomella ciliata Petrak 1947	Lebanon, ascomycete
Thryptospora singularis Petrak 1947	Lebanon, ascomycete
Adlerocyctis parkeri Feld.-Muhen & Havivi 1963	Palestine-Israel, zygomycete
Rhexothecium globosum Samson & Mouchacca 1975	Egypt, ascomycete
Hyalocladium moubasherii Moustafa 1976	Kuwait, deuteromycete
Desertella globulifera Mouchacca 1976	Egypt, deuteromycete
Clavispora lusitaniae Rod. De Miranda 1979	Palestine-Israel, yeast ascomycete
Thermophymatospora fibuligera Udagawa *et al.* 1986	Irak, deuteromycete
Setosporella mahmoudii Moustafa & A.-Wahid 1989	Egypt, deuteromycete
Chaetomiopsis dinae Moustafa & A.-Wahid 1990	Egypt, ascomycete
Mucobasispora tarikii Moustafa & A.-Wahid 1990	Egypt, Deuteromycete

The implication of fungi in the various fields of modern biotechnology is actually expanding very rapidly. In this respect, the establishment of a regional centre of fungal taxonomy should be a decisive action in order to accelerate our knowledge of the Middle East mycobiota. This centre should, however, be provided with specific continuous flow of resources ensuring durable links with major taxonomic institutions present in Europe or elsewhere.

acknowledgements

The author is particularly indebted to the organisers of the Symposium on Natural Resources and Their Conservation in Egypt and Africa (19-21 March 2001) for the opportunity to participate in this interesting meeting. Sincere appreciations are extended to Prof. El-Sayed A.A. Fleifel, Dean of the Institute of African Research and Studies, Cairo University, to Prof. Samir I. Ghabbour, Department of Natural Resources of the same and to members of the Institute Executive Board for facilities awarded during his visit at the Institute. Prof. MikhailZ.A.Wafai,Vice-Deanfor_Environmental Affairs, and all the personnel of the Department of Natural Resources have generously given much of their time to make my stay at the Institute a most pleasant one.

Tab. 1. Localities of origin and chronology of introductions.

State /Years 1940 to		-50	-60	-70	-80	-90	>90	T	%
SAUDI-ARAB.	(SA)	-	-	-	-	1	2	3	1,43
JORDAN	(JO)	-	-	-	3	-	-	3	1,43
OMAN	(OM)	-	-	-	-	-	4	4	1.92
LYBIA	(LY)	-	-	-	4	-	-	4	1,92
SUDAN	(SU)	-	-	-	1	4	1	6	2,87
KUWEIT	(KU)	-	-	-	4	3	-	7	3,35
LEBANON	(LE)	9	-	-	1	-	-	10	4,78
SYRIA	(SY)	1	-	13	-	-	-	14	6,70
IRAK	(IR)	1	-	4	3	7	14	29	13.88
EGYPT	(EG)	-	1	10	24	13	4	52	24,88
PALES./ISRAEL	(PI)	21	15	18	5	9	9	77	36,84
Total/decade	(Y=35)	32	16	45	45	37	34	209	

seeked for the production of products with high enzymic or antibiotic activities.

CONCLUSIONS

Now what conclusions could be extracted from the analysis of information conveyed by names of fungi introduced in the last sixty years from localities situated in the Middle East region?

First, the simple total of 209 introductions corresponds to a mean value of less than four cases per year. This is a meaningless value when compared to the present annual volume of descriptions; the latter turns around a figure of two thousand species. Clearly interest in the study of fungi in this region is definitely limited not to say rather inexistant. Such a dominant tendancy ought to be reversed on the simple fact this wide arid area do harbour a specific mycobiota. However, the former major observation should be tempered by the fact the majority of present introductions resulted from efforts undertaken by local mycologists. These efforts gain weight if we also consider introductions resulting from cooperation with colleagues external to the area. In the Middle East, taxonomic mycologists have been principally active in Egypt, Irak and the complex Palestine-Israel. Unfortunately their respective specialists have now attained a retiring age with no evidence of replacement by younger candidates.

The present level of taxonomic achievements will thus not even be maintained at its actual low state.

Available data underlines a significant absence of data on particular divisions of fungi. This is evident for Protoctistan and Zygomycetous fungi. Both divisions have definitely not received any attention although their representatives in such a dry region should disclose interesting discoveries. The Ascomycetes and the deuteromycetes were better investigated. Clearly their plant related forms were less explored in comparison to the soil inhabiting components. Indeed few attention has been given to fungi of both divisions developing on standing plants being natural or under cultivation.

The Basidiomycetes proved to be the least studied major taxonomic fungal division. The situation is particularly of deep concern especially with regard to their phytopathogenic forms being the rusts and the smuts. The potential local biodiversity of these parasites awaits to be surveyed. Several are known to be agents of severe economic losses of standing crops.

On another topic, a complete absence of cooperation between local mycologists is manifest. The only links that surfaced during the present analysis are those sporadically entertained most commonly with European mycological centres. Contacts between mycologists of the Middle East ought to be favoured by all means. Such would enhance the sharing of present local expertise and expedite exchange of information.

non eumycotan fungi. Interest of external mycologists mostly European ones accounts for half of the new taxa being either Ascomycetes or deuteromycetes; research leading to the proposal of the second half was achieved at the Department of Botany, Suez Canal University. For the Nile Valley, most introductions have a soil origin; only few were observed on plant or dung material. Simply 4 binomials concern phytopathogenic forms and these were characterized by local specialists. This shortcoming stress the need to develop local research on destructive agents of standing crops.

Introductions of the complex Palestine-Israel (77 proposals) could be dispatched pending publications dates in two parts. The years from 1941 to 1961 correspond to the active period of T. Rayss, who authored practically all relevant binomials. She studied fungi of soil and plant material belonging to most taxonomic divisions except the Hymenomycetes. After 1961, a series of new authors will demonstrate their interest to pathogenic forms of the divisions Basidiomycetes, Chytridiomycetes or Zygomycetes. Nonetheless, these late proposals from this small area appear not to be correlated with the emergence of any well established taxonomic centre.

Ecological attributes of introduced taxa

Fungi differ in their ability to develop at high temperatures. Thermophilic species grow at the range of temperatures from 20°C-60°C. Thermotolerant taxa have a temperature growth range from ca. 8°C-45°C or even 52°C. But the number of fungi developing at high temperatures is reduced in comparison to the mass of mesophilic species able to grow only in the range from 5°C-35°C.

Now when examining the ecological attributes of the Middle East novel fungi, some proved their ability to develop under conditions of temperatures and osmotic pressures commonly unfavourable for growth of mesophilic species.

All over 21 members exhibit such features (Tab. 7). Most are thermotolerants but few qualify as thermophiles. This group also comprise a xerotolerant ascomycete, i.e. a fungus able to grow in notable dry conditions, and two osmothermotolerant members, i.e. fungi developing at high temperatures in a dry environment.

This small ecological group represents 10% of all taxa introduced for the region. Its 5 thermophilic members correspond to 15% of all presently known thermophiles (Mouchacca 1997, 1 999a). All its members have a common soil origin. The discovery of soil-borne fungi with particular physiological attributes is definitely related to the arid conditions prevailing in the Middle East region, part of the large North African desert belt that also extends far away to the east of Egypt. The marked aridity of this zone is behind the development of living forms able to survive an environment too often extreme for common forms of life. The isolation of new thermophiles and thermotolerant fungi is also particularly interesting in terms of biotechnological potential. New fungal molecules are nowadays continuously

The three deuteromycetes with original localities in Saudi Arabia disclose all possible combinations. The recently described *Cercospora saudii* was introduced by a local mycologist. *Rarnichioridiurn rnackenziei* was jointly characterized by a visiting professor and a local colleague; it was isolated from an old female suffering brain abscesses; now it is recognized as a synonym of another member of the genus. *Alternaria selinii* was named by an american mycologist and based on a specimen collected by a British botanist during a foray in Saudi Arabia subsequently deposited at Kew Gardens (London).

Among the 3 Jordanian taxa, collection and description of *Cylindrotrichurn goni* is due to an Italian mycologist; original strains of the other two were obtained by Egyptian mycologists but *Coniochaeta nodulisponoides* was described by a British specialist. Three out of four *Omanese ascomycetes* developed from local dung material kept in humid chambers in Spain leading to a joint published work; the soil-borne *Ernericella ornanensis* was isolated and precised by two Japanese taxonomists. About the 4 Libyan taxa, only the one isolated from a nematode implies a local mycologist while visiting a British centre

The six taxa originiating from The Sudan are due to European specialists though the local ElShafie assisted in the characterization of *Drechslera gedarefensis* during a stay in UK. The 7 Kuwaiti units were proposed between 1973 and 1989; they result from work undertaken by the Egyptian mycologist A.F. Mostafa at the Department of Botany of Kuwait University; the recent *Chrysosporiurn zonaturn* correspond to a joint study with a Dutch colleague.

The situation is dissimilar when considering Lebanon with 10 binomials introduced in the sole years 1946 and 1947 by F.Petrak from Vienna based on J. Bornmuller collections and by T. Rayss based on material deposited at the Herbarium of the Hebrew University of Jerusalem. Rayss also authored the description of *Tilletia sphenopodis* collected in 1931 in Syria. For this country, the 13 proposals of *Pencilliurn* resulted from the Ph.D. thesis of Baghdadi submitted in 1968 in the Soviet Union; interestingly this author ceased his taxonomic activity upon his return.

For the former states, it is clear respective introductions are definitely not correlated with any developing centre of taxonomic expertise.

For Irak (29 proposals), the first S introductions - due from 1941 to 1966 - were made by European mycologists. But from 1976, S.K. Abdullah will initiate a taxonomic unit at Basrah University. An interesting series of publications will then be produced focusing on the Systematics of the Ascomyetes. No effort will, however, be undetaken to survey local plant pathogenic forms. Published work will be achieved partly in collaboration with Indian, Japanese, British and more recently with Spanish colleagues.

For Egypt (52 proposals) the first binomial was coined in 1952 for the Chytrid Rhizophydiurn racemosurn; this is also the sole local discovery of a

observations add weight to the former one about the leading status of soil studies undertaken in the area.

On plant substrates the deteuromycetes are represented by 21 genera. 16 have phytopathogenic attributes but only few could be qualified as obligate phytopathogens: Cercospora Fre sen., Cercosporina Speg., Oidium Ehrenb., Phaeoramularia Munt.-Cvetkovic and Septoria Sacc.; remainders are simply secondary parasites able to sporulate on normal laboratory cultures. Deuteromycetes of other substrates are an assemblage of taxa isolated from larvae, horse hair and soil nematodes. *Aspergillus fiaschentraegeri* Stolk is a notable member of this last group. The fungus was isolated from larvae of Prodenia litura in Alexandria City but never reported again in the literature. From a taxonomic point of view, deuteromycetes are either hyphomycetes or coelomycetes. The latter are known to be important plant pathogens of natural plants or of crops of economic importance. They are here represented by 7 genera only: *Ascochyta Lib., Ascochytella tassi, Cytosporina sacc., Diplodia Fr., Phorna sacc., Phyllosticta pers. and Stegonsporiurn corda.* It is apparent research on coelomycetes have not yet attracted the attention of local specialists. This is mostly unfortunate due to the particular local botanical flora be natural or cultivated. Attention to coelomycetous taxa should lead to interesting discoveries. In fact the overall features of the deuteromycetous genera recorded clearly reflects the prevailing low level of regional taxonomic expertise regarding their phytopathogenic forms.

The fifteen basidiomycetous genera exhibit a preferential link to plant material. The genera *Agaricus L., Russula pers. and Tricholorna* (Fr.) Staude harbour species producing carpophores on the soil surface. These hymenomycetes were collected exclusively in the complex Palestine-Israel in forests of Quercus calliprinos and Pinus halepensis. Crepidotus variabilis var. stercorarius developed on horse dung. Among the genera linked with plant material, species of *Galzinia Bourdot, Hyphoderrna fr., Lepiota (Pers.) Gray* and *Macowanites kalchbr.* developed on decomposing plant parts

Regarding the 7 remaining genera of the division, their representatives are either rusts or smuts. The 5 smuts are species of *Entyloma* de Bary, *Tilletia* Tul. & C.Tul. and *Ustilago* (Pers.) Roussel. The 11 reported rusts rather belongs to *Puccinia* Pers. and *Urornyces* (Link) Unger since for *Aecidiurn* Pers. and *Uredo* Pers. only one proposition was established. This low number of introduced rusts and smuts implies such fungal forms have not received appropriate attention at the regional level. Consequently limited information is presently available on these obligate parasites of natural plants or of crops of economic importance grown in this vast arid region.

Centres of taxonomic expertise in the region

A scrutiny of the nationality of specialists behind the 209 proposals determines potential centres of taxonomic expertise. It also delimits respective interest of local mycologists and of external ones. Again this analysis will also underline the diversity of individual routes with final issues being the description of a new taxon.

at the Natural History Museum of Paris. Both cases correspond to work undertaken by mycologists operating outside the Midle East region but who became interested for one reason or another to the local mycobiota

The deuteromycete *Hyalocladium moubasheni* was introduced by the Egyptian A.F. Moustafa in 1976. The original living culture was obtained during a survey of the fungal air spora of the state of Kuwait. The species was dedicated to A.H. Moubasher, Professor of Mycology at Assiut University. Moustafa later on undertook some research on Egyptian fungi during his subsequent stay at the Suez Canal University, Ismailia City. There a small taxonomic unit was initiated. Presently this unit definitely requires institutional support. The hyphomycete *Thermophyrnatospora fibuligera* Udagawa, Awao and Abduila was described in 1986 from living cultures isolated by S.K. Abdullah from an Iraki date palm plantation. The project was a sound cooperation between a local mycologist and colleagues of a far away country such as Japan.

Distribution of genera following substrate types and localities of origin

Only data relating to the three major taxonomic divisions will be considered. Ascomycetous genera are found to originate mainly from Egypt, Irak and the complex Palestine-Israel; elements from the six other states form a subgroup of 20 units (Tab. 4). Less than one third is linked to other substrates: dung material and two insect parasites. The genera *Arniurn Nitschke* ex *G.winter, Coprinus korf & kimbr., Preussia fuckel, Podospora Ces. and Saccobolus boud.* are well known for their tight links with dung material. Thus for *Preussia, Podospora* and *Saccobolus*, 2-3 species were respectively described. The genera *Chaetornidiurn* (Zopf) Sacc. and *Chaetorniurn kunze* comprise soil-borne fungi and species developing on dead plant material. Some Ascomycetes were thus isolated in pure culture; the dung related species were mostly defined from material developing in humid chambers.

Also slightly more genera were reported from soil than from plant material. Soil genera also comprise most units with more than one species. The present high proportion of soil-borne ascomycetes underlines the notable interest of mycologists for natural or cultivated lands of this wide area. For the plant related ascomycetes, more species were observed on decomposing plant material or on seeds (*Chaetorniurn dreyfussii* von Arx and *Setosphaeria khartournensis fiShafie & J.webster*) as compared to species developing on standing crops. This pattern confirms the limited interest awarded to plant pathogenic ascomycetes.

In comparison, deuteromycetous taxa are related to a lower total of genera. This is due to 10 units each having two taxa or more. Pen icilliurn Fr. alone is distinguished by 12 propositions followed by Aspergillus Link with 6 species.

Members of this division exhibit marked affinities with soil. This substrate has also provided the S relevant genera new to science. Both

remains. It should also be noted that substrates other than soil and plants have developed a good number of new Ascomycetes but comparatively less new deuteromycetes.

On the other hand the reduced figures of newly described Chytrids and Oomycetes are related to plant material only. Fungi of both divisions are parasites of plants and animals. Their respective low rates add weight to the former observation on both divisions: there is a marked absence of taxonomic expertise in these fungi at the Middle East level. The Zygomycetes seems to have simply been studied in relation with other substrates. These fungi are also known to inhabit soil but knowledge of their presence in those of the Middle East has not been developed in the last decades.

Genera represented

Binomials introduced for fungi of this arid region relate to 122 genera (Tab. 3). Their distribution following the species numbers per genus confirm almost 75% of these genera are connected with one species; only 18 genera are associated with three species. This is a clear statement no monographic taxonomic work was undertaken on fungal genera intimately associated with the land and vegetation of the arid Middle East region. Monographic work on a genus in a particular area generally produce a fair number of new species.

The Ascomycetes and the deuteromycetes, the two dominant divisions in terms of contributions, also have highest generic numbers. But in this respect, the Ascomycetes ranks first. Thus the mean number of ascomycetous species/genus is lower than the corresponding figure of the deuteromycetes. Indeed the latter division has higher cases of genera with more than 3 species. For the Basidiomycetes, the 30 proposals are linked to to 15 genus only.

Genera new to science

Among the genera observed 11 proved to be new to science at the time of their proposition (Tab. 4). Their type species are thus based on material collected in the Middle East. Six have original localities in Egypt, others are from Iraq, Kuwait, Lebanon and Palestine-Israel. Individual generic histories are a good example of the astonishing diversity of routes leading to the discovery and the description of a new fungus. Few cases could be considered.

The binomial *Neobroornella ciliata* was introduced by the Austrian F. Petrak in 1947. This ascomycete developed on dead stems of Phiornis brevilabris collected by J. Bornmijller in 1897 in Lebanon and Syria; specimens were then deposited at the Natural History Museum of Wi en. The genus has still only one species attached to it, i.e. a unispecific genus. The deuteromycete Desertella glob ulifera was described in 1979 by J. Mouchacca. It was based on living cultures isolated from a soil sample collected years ago in the oasis of Kharga, Western Desert of Egypt, hence the generic name. These soils were investigated

divisions. Evidently more interest was directed to the study of Ascomycetes and deuteromycetes in this wide arid zone.

Correlations between taxonomic characters and localities of origin are also interesting to debate. The three divisions with lowest rates suggest exclusive links with the complex Palestine-Israel. The Middle East region thus remains largely inexplored regarding some specific groups of fungi as the Chytrids, the Zygomycetes and the Oomycetes. In other words, a total absence of interest for these divisions prevails among local mycologists. Alternatively no foreign specialist developed such interest for that region. Chytrids and Oomycetes and less so for Zygomycetes are, however, known as parasites of plants and animals able to induce severe losses in some infection cases.

The division Basidiomycetes displays a global trend approximating that of the former divisions. It deviates, however, by the few taxa with original localities situated in Irak and Syria. It follows not a single Basidiomycete new to science was thus proposed in that period either from Egypt or from the seven other remaining states.

The Ascomycetes and the deuteromycetes, the best two contributing divisions, are represented in almost all states but with dissimilar frequencies. Highest figures for the former are overwhelming in Egypt and Irak and less so for the complex Palestine-Israel. For the deuteromycetes marked values relate to Egypt and the complex Palestine-Israel but here Syria ranks third. For both divisions present data reflect the degree of interest of local mycologists for their members plus the contribution of foreign specialists.

Substrate type and taxonomic divisions

Fungi proposed from the Middle East were observed developing on substrates of varying nature (Tab. 3). The examined material could tentatively be separated into three groups: organs of living plants (leaves, roots, trunks, seeds, bulbs, etc..) and their decomposing remains; soil supporting a natural or cultivated plants or without a vegetation cover; and other types of substrates as material of animal origin and infected insects. Basidiomycetes with basidiocarps developing on the soil surface were integrated in the second group.

Correlations between substrate types and taxonomic characters clearly underline plant material and soil are the two major sources of almost all described fungi. Names proposed for taxa of other substrates simply amounts to 15% of total introductions. Interestingly plant material and soil exhibit equal high total figures but this similarity is apparently casual.

When considering both previous parameters interesting links could be extracted. Proposals of soil Ascomycetes and deuteromycetes are found to outnumber corresponding figures from plant material. Soils of the Middle East region thus appear to go a good reservoir for new fungi of both taxonomic divisions. Inversely, mycological investigations favoured the study of soil fungi rather than fungi developing on cultivated or natural plants and their

introduction is, however, not stabilized around the mean. It shows a decrease in the fifties followed by an increase in the next two decades and a subsequent slackening around the mean. The overall tendancy suggests the absence of a correlation between the activity of describing new species of fungi and the recent economic development of the region.

At the level of the three major geographic subdivisions of the Middle East, proposals originating from the Arabian Peninsula (6,70%) appear meaningless. On the other hand, relative contributions of countries situated north of the peninsula, i e. the near east region, attains the two-thirds of the total; the remaining third is due to the three states of north east Africa

At the state level, four from the Arabian Peninsula (the present Yemen and the Gulf states) are not associated with a single proposal. At this point, it is evident the relative contribution of thenorth east African states is mainl due to studies relating to Egyptian fungi. For the near east states, the complex Palestine-Isreal is leading. These two basic units cumulate almost two-thirds of the entire proposals; the remaining third is mainly generated by the Iraki and Syrian contributions. State contributions mark the relative importance of work undertaken on fungi in Egypt and the complex Palestine-Israel. Concomitantly, similar interest seems to be totally lacking in countries with marked surface areas as The Sudan, Lybia, Saudi Arabia and even Syria.

Now let us view the same data by considering two parameters simultaneously. The first possibility is to correlate localities of origins with dates of introduction. Three state groups could thus be delimited. Six have individual rates of proposals respectively lower than 3.35 %; also their introductions were in general made starting from 1970. Lebanon and Syria exhibit close percentages but their proposals were made either in the forties for Lebanon and in the sixties for Syria, i.e. before any proposal of the former six states with the lowest relative contributions.

For the remaining three states relative shares disclose a different trend. The complex Palestine-Israel exhibits a continuous deceleration since the fifties. For Irak there is a gradual but slow progression starting from the sixties. For Egypt a similar progression is observed only up to the seventies and before a serious reduction. This differential trends are presumed to reflect local policies in terms of studies of cryptogams. But the real factors behind such evolutions are, however, not simple linear parameters. This is basically due to the intervention of mycologists active in taxonomic centres situated outside the region.

Taxonomic characters and localities of origin

When viewing the same proposals but based on the taxonomic characters of fungi described, seven taxonomic divisions are delimited (Tab. 2). Pending their relative contributions divisions Ascomycetes and deuteromycetes are the two dominant ones; they disclose similar percentages amounting to two-thirds of all introductions. The Basidiomycetes ranks third with a relative contribution almost equal to the total of the four remaining

the taxon being invalidly published. Once specified illegitimate binomials should no longer be used to designate a fungus.

Regarding the taxonomic status, two situations are commonly encountered: the species is reported to be a later synonym of a previously described taxon; the taxon might have made the object of a generic change. Ultimately the name has not received any further affention. Furthermore for fungi taxonomic implications are a bit more complicated when compared to any other group of living organisms since a fungus may possess both an anamorphic and a teleomorphic states. In the present work the justification of many infraspecific taxa (new formae or new varieties) was considered insufficient to be distinctive from their host species. Several synonymies were also proposed for unwarranted taxonomic decisions (Mouchacca 1995, 1999).

Taxonomic changes affecting introduced binomials are best exemplified by the three Egyptian-borne taxa established by van Beyma (Beyma 1993 a & b) in relation to the work undertaken by Sabet (Sabet 1935, 1939). The generic affinities of two have undergone changes as more taxonomic revisions were accomplished since their introduction. For *Penicilliurn egyptiacurn* van Beyma, the binome *Eupenicilliurn egyptiacum* (van Beyma) Stolk & Scott should now be used sinc this Penicililiurn readily produces ascomata in culture. *Oospora egyptiaca* van Beyma is now better accomodated as *Acrernoniurn egyptiacurn* (vanBeyma) W.Gams

No name change was, however, discovered for the third binomial Cryptornela acutispora van Beyma. In fact the fungus was only reported once since its description. The report is due to Ah (1977) from soil collected in a desert valley near Riyadh City, Saudi Arabia. However, this finding is most prabably a case of misidentification. Re-examination in 1994 of the corresponding original strain proved it rather represents myrotheciurn verrucaria (Albertini & Schweinitz) Ditmar:Fries (Mouchacca 1995). This is a simple case of misidentification frequent in the early literature since mycologists were then deprived of the presently available updated critical books on the taxonomy of fungi. These situations clearly stress the study of fungi is not a simple straightforward system.

It follows that when preparing a regional checklist a large number of documents either recent or less recent should be scrutinized by a specialist having a good level of taxonomic expertise. This mass of publications is available only in a few large specialized libraries. Unfortunately such a shortcoming in developing countries hinders this type of basic research. Several names could thus be still in use for the same organism. This is most critical when fungi pathogenic to plants are concerned.

Chronology of introductions and original localities

For the fifteen states of the Middle East, interestingly only 209 proposals were formulated in the last six decades (Tab. 1). The chronology of these introductions discloses a continuous interest in the fungi of the area starting from 1940 with a mean of 35 cases each ten years. The rate of

Interest in the fungi of this area became marked after the first world war (Reichert 1921). The trend related in particular to fungi pathogenic to natural plants or to crops of economic importance. For soil-borne fungi, the pioneer work of Y.S. Sabet on Egyptian soil fungi published in 1935 and 1939 is now accepted as the starting point of research on these particular communities. The exploration led to the proposal of three species new to science. Their description is due to van Beyma in 1933 (van Beyma 1933 a & b). Original strains examined by the Dutch mycologist are still maintained alive in the major living culture collection of the Centraalbureau voor Schimmelcultures, Baarn (now at Utrecht), The Netherlands.

At the present time, a global document on fungi of the Middle East is not available. But on a state level, few lists of fungi parasitic on plants have been prepared following the second world war (Johnston & Booth 1983). These defnitely require a complete revision of their contents. Nowadays, there is a move to propose critical checklists of known fungi at the local level. Available partial contributions are due to Moustafa (1975, 1978) for Kuwait and to El- Abyad (1997) for Egypt. A similar but exhaustive document for Libya is authored by El-Buni and Rattan (1981). At the regional level, Moubasher made the first attempt to bring together data on soil fungi in an interesting book that appeared in 1993.

NEW BINOMIALS INTRODUCED

To prepare a list of fungi considered as being new to science at the moment of their description the Index of Fungi has to be scanned. This twice a year publication is issued by the CABI Bioscience Egham Centre (formerly the International Mycological Institute, Kew, UK). The title started in 1940 under the name The Review of Applied Mycology. Before 1940, names of new fungi were not constantly compiled and published alltogether. To prepare this index copies of all mycological journals are continuously examined and new names retreived. For each, the index provides the original bibliographic reference with notes on the locality of origin, the taxonomic group, the legal taxonomic status of the coined binomial and features of the material studied.

DISCUSSION

The scope of this contribution on new fungi originating from the Middle East is far from being a simple compilation. Indeed, for each name introduced the maximum effort was displayed to re-assess not only its nomenclatural state but also its taxonomic position. This reappraisal is crucial for a critical checklist: the status of all names have to be updated by going through all presently available taxonomic books and publications.

Each name has a nomenclatural and a taxonomic status. The first implies applications of articles of the Code of Botanical Nomenclature governing the publication of a name. Omissions of Latin diagnosis (Art. 36 ICBN) or type designation (Art. 37) (or both) is a fault commonly encounterted in early literature or made by unexeperienced authors leading to

essential. The establishment of a regional centre of fungal taxonomy provided with long standing collaborative links with foreign laboratories should be a decisive appropriate measure.

Key-Words: novel fungi, documentation, biodiversity, taxonomy, phytopathogens, oomycetes, chytridiomycetes, zygomycetes, ascomycetes, basidiomycetes, deuteromycetes, Middle East, Egypt, Irak, Palestine-Israel.

INTRODUCTION

This research project started a number of years ago following my Ph.D. thesis on soil fungi inhabiting arid lands of the New Valley depressions in Egypt. The telluric fungal communities of Kharga and Dakhla oases were then investigated. A number of interesting living cultures were obtained in the course of this study. Trials to put a name on each proved several to represent species being new to science. In order to provide a legal valid binomial for these taxa pure taxonomic work had to be undertaken.

Taxonomic work on soil fungi of the New Valley area resulted in the proposal of several taxa new to science (Mouchacca 1995). This activity developed the idea of analysing the outcome of similar research undertaken at the Middle East level. The first relevant published account was prepared from data that had accumulated since my doctorate degree on mainly new soil-borne fungi of the region. The account concerned about 40 species (Mouchacca 1995). The second step was to retreive names of all other fungi with original localities situated in this zone. These amounted to a hundred and fifty with most being obligate parasites of plants or animals (Mouchacca 1999 a and b).

The third step implies a synthesis of data characterizing names treated in both contributions in an attempt to extract interesting correlations on the Middle East level, a geographic zone submitted to specific arid climatic conditions (Mouchacca 2001). This synthesis is a good example of how to inventorize natural resources of a particular group of living organisms inhabiting a particular region as the one under consideration. The present project will, however, be pursued by the preparation of a similar critical list of fungi for the three north west African countries. The final goal would be a check-list of novel fungi described from the Arab World since 1940.

MYCOLOGY IN THE MIDDLE EAST REGION

The three countries of north east Africa, namely Egypt, Lybia and The Sudan constitute with the other Arab states of western Asia the geopolitical region termed The Middle East. The area is an assemblage of 15 political states with a total surface area of about 9 millions km^2, all submitted to an arid climate. In this vast zone, agriculture is subject to the presence of regular volumes of superficial running waters originating from sources situated outside the region, as the river Nile, or due to the discovery of important amounts of underground fossil water.

NEW FUNGI DESCRIBED FROM NORTHEAST AFRICA AND OTHER ARAB COUNTRIES SINCE 1940. WHAT CONCLUSIONS COULD BE DRAWN FROM THIS SCIENTIFIC ACTIVITY?

Jean Mouchacca,
Laboratoire de Cryptogamie, Muse'um National d `Histoire Naturelle,
12 rue Buffon, 75005 Paris, France
(e-mail: mouch@mnhn. fr)

ABSTRACT

The eastern part of the Mediterranean sea is the maritime facade of the geopolitical Middle East. Its fifleen states cover around 9 million km^2, all subjected to an arid climate. Research on local mycobiota led to the discovery of xtaxa then regarded as being new to Science. Since 1940, simply 209 taxonomic units were introduced. For most, collecting sites are in Egypt, Palestine-Israel or Iraq; only one quarter relates to eight other states. All novelties are linked with 122 genera comprising 51 Ascomycetes, 41 deuteromycetes and 15 Basidiomycetes; only half of the latter are plant pathogenic forms. Zygomycetes, Oomycetes and Chytridiomycetes are less represented. Ten new genera of Ascomycetes and deuteromycetes were proposed with original sites almost limited to the former three states.

Minor taxonomic divisions have thus not received proper affention though following the prevalent aridity interesting discoveries should be expected. For Ascomycetes and Deuteromycetes, more interest was directed to the soil-borne representatives than to their plant-related forms including standing crops. Basidiomycetes proved to be less explored on the regional scale, despite of a fair number of rust and smut fungi being of economic importance. On the basis of their ecology, a limited fraction of introduced taxa exhibits notable thermotolerant abilities and some even qualify as thermophiles; in comparison definitely less xerotolerant fungi were disclosed.

Since 1940, less than four taxonomic units were thus proposed per annurn. This underlines the limited interest given to the biodiversity of fungi in the Middle East, an area presumed to harbour a specific mycoflora. Most proposals were achieved by mycologists active in Egypt, Israel and Iraq. However, a scrutiny of authors' names stress the absence of any collaboration among local taxonomists. These entertain sporadic links with colleagues of the near-by European centres and less so with far ones in North America or elsewhere. The present dominant situation needs to be reversed by promoting inter-state contacts to share present expertise and favour information exchange.

Finally, in view of the overwhelming implication of mycology in the fields of biotechnology, adequate knowledge of the Middle East mycoflora is

التنوع النباتي مع التغير في الارتفاع وخطوط العرض على الجانب الشرقي والغربي للبحر الأحمر

أ.د. أحمد كامل حجازي

د. وفاء محروس عامر

جامعة القاهرة – كلية العلوم – قسم النبات – الجيزة ١٢٦١٣

الملخص

تشتمل بيئة البحر الأحمر على ثلاثة بيئات أساسية هي: الملاحات الساحلية والسهول والجبال. وقد أدى هذا التباين في الارتفاع والتوبوجرافيا الى تحديد المناطق النباتية وتنوع النباتات مع التغير في الارتفاع وخطوط العرض.

بالنسبة للارتفاع فيبدأ من سطح البحر وينتهي بأعلى القمم بمحاذاة البحر. ودراسة التنوع النباتي لهذه المنطقة له أهمية في الكساء النباتي والجغرافيا النباتية لما لهما من علاقة مع المناطق المجاورة في أفريقيا واسيا.

وتركز الدراسة الحالية على ستة مواقع أساسية هي: جبل جيدم في إريتريا وعسير والحجاز في السعودية وعلبه والشايب وجنوب سيناء في مصر. وتمت دراسة مواقع جيدم والحجاز وعلبه من خلال المراجع أما عسير والشايب وجنوب سيناء تمت من واقع الدراسة الحقلية مع توثيقها بالمراجع.

التنوع النباتي والعلاقات النباتية تم تحليلها في الارتفاع الأقل والأوسط والأعلى وكذلك في الاتجاه من الجنوب إلى الشمال ومن شاطئ البحر إلى أعلى الجبال. وكانت بيئات الملاحات الساحلية هي أقل البيئات في التنوع النباتي ويزداد التنوع في السهول الساحلية ويوجد أعلى تنوع في البيئات الجبلية في الارتفاع من ١٥٠٠ – ٢٠٠٠ م فوق سطح البحر في الجبال الجنوبية وبين ٥٠٠ – ١٠٠٠ م فوق سطح البحر في الجبال الشمالية ويتبع ذلك تناقض في التنوع النباتي في الارتفاعات الأعلى.

كان التخصص في الأنواع النباتية بالنسبة للارتفاع والمناطق ملحوظا في الجبال الجنوبية عنها في الشمالية على جانبي البحر الأحمر. ودراسة الاختلاف في المناطق النباتية أظهر تناقض واضح في التنوع النباتي في اتجاه الشمال وان هناك مناطق تداخل بين عدد كبير من الأنواع تميز نطاق التنوع بين المجتمعات النباتية قبل تغيرها كليا في الاتجاه من الجنوب إلي الشمال.

منطقة البحر الأحمر تمثل تداخل بين منطقتان أساسيتان للجغرافيا النباتية وهما: السودانو- زامبيزيان والصحارو--سنديان ويعطى هذا منطقة البحر الأحمر تنوع نباتي ملحوظ مع وجود تشابه في الكساء الخضري على جانبي البحر.

salt marsh, Egypt. *Ecological monographs.* 37: 297-315.

Liddicoat, W.K. (1971). *The North Samran exploration area.* Saudi Arbian Directory General of Mineral Resources. Technical Record, TR 1971-1.

Migahid, A.M. (1988-1990). *Flora of Saudi Arabia.* (3rd Edition). vol 1: 251 pp. (Equisetaceae-Neuradaceae); vol 2: 282 pp. (Leguminosae-Compositae) & vol 3: 150 pp. (Hydrocharitaceae-Orchidaceae). King Saud University, Saudi Arabia.

Nebert, K. (1970). Geology of Jabal Samrah and Jabal Farasan region. Kingdom of Saudi Arabia. *Saudi Arabian Directory General of Mineral Resources Bulletin,* No.4.

Ozenda, P. (1977). *Flora Du Sahara.* Centre National de la Recherche Scientifique. Paris, France. 621 pp.

Quézel, P. (1978). Analysis of the flora of Mediterranean and Saharan Africa. *Annuals of the Missouri Botanic Garden,* 65: 479-534.

Springuel, I. (1997). Vegetation, land use and conservation in the South Eastern Desert of Egypt. P. 177-206. in: Barakat, H.N. & Hegazy, A.K. (eds). *Reviews in Ecology*: Desert conservation and development. Printed by Metropole, Cairo, Egypt.

Täckholm, V. (1974). *Student's Flora of Egypt.* Ed. 11 Beirut: Cairo University Press. 888 pp.

Teketay, D. (1995). Mountain chronicles. Floristic Compostion of Dokata Valley, southeast Ethiopia: an amplication for the conservation of biodiversity. *Mountain Research and development,* 15(12): 183-186.

Vetaas, O.R. (1992). *The interaction between biotic and abiotic factors Controlling temporal and spatial dynamics of arid vegetation In Erkowit, North-Eastern Sudan.* Ph. D. thesis, University of Bergen, Norway.

Vesey-Fitzgerald, D.F. (1955). Vegetation of the Red Sea Coast South Jedda, Saudi Arabia. *Journal of Ecology,* 43: 477-489.

White, F. (1950). The forests of Mt. Kenya. *Forest Society Journal,* Oxford University for Soc. Ser. 3, 5.

White, F. & Leonard, J. (1991). Phytogeography links between Africa and South-West Asia. *Flora de Vegetatio Mund,* 9: 229-246.

Wickens, G.E. (1976). The flora of Jabal Marra (Sudan Republic) and its Geographical Affinities. *Kew Bulletin,* Additional Series V. London: HMSO. 199 pp.

Wilson, M. V. & Shmida, A. (1984). Measuring beta diversity with presence-absence data. *Journal of Ecology,* 72: 1055-1064.

Zahran, M.A. (1983). *Introduction to plant Ecology and Vegetation types in Saudi Arabia.* King Abdulaziz University. 142 pp.

Zahran, M.A. (1977). Africa A. wet formations of the African Red Sea Coast. P. 215-218. In: *Wet Coastal ecosystems, Ecosystems of the world 1.* Chapman, V. J. (ed). Elsevier, Scientific Publ. Amsterdam, Oxford, New York.

Zohary, M. (1972). *Flora Palestina.* 2. Israel Academy of Science and Humanities, Jerusalem. 489 pp.

& Head, S.M. (eds). *Red Sea*. Oxford: Pergamon Press. 441 pp.

Edwards, F.J. & Head, S. M. (eds.) (1987). *Red Sea*. Oxford: Pergamon Press. 441 pp.

El-Hadidi, M.N. (1969). Observation on the Flora of the mountain region. Extract Du *Bulletin LA Societe de Geographic D' Égypt*, T. XI: 142-155

El-Hadidi, M.N. (1993). Natural vegetation. In: Craig, G.M. (ed.) *The Agriculture of Egypt*, Oxford University press. Oxford. P. 39-62.

El-Hadidi, M.N. & Hosni, H.A. (1996). Biodiversity in the Flora of Egypt. P. 785-787. In: Van der Maesen, L.J.G. *et al.* (eds): *The Biodiversity of African Plants.* Proceeding XIV[th] AETEAT Congress 1994. Kluwer Academic Publ. Dordrecht.

Fayed, A.A. & Zayed, K.M. (1989). Vegetation along Makkah-Taif road (Saudi Arabia). *Arab Gulf Journal for Scientific Researches*, 7: 97-117.

Furon, R. (1963). *Geology of Africa*. London, Oliver & Boyd, 377 pp.

Ghazanfar, S.A. (1991). Vegetation structure and phytogeagraphy of table shams, an arid mountain in Oman. *Journal of Biogeography*, 28: 299-309.

Gibali, M.A. (1988). *Studies on the Flora of Northern Sinai.* M. Sc. Thesis, Cairo University. 403 pp.

Hassan, L.M. (1987). *Studies on the flora of Eastern Desert*, Egypt. Ph. D. thesis, Cairo University. 515 pp.

Head, S. M. (1987). Introduction. p.1-21. In: Edwards, A. j. & Head. S.M. (eds). *Red Sea*. Oxford: Pergamon Press. 441 pp.

Hedberg, O. (1951). Vegetation belts of the East African mountains. *Svenk Bot. Tidsky.*, 45: 140-202.

Hedberg, O. (1964). Features of Afro-Alpine plant ecology. *Acta Phytogeographica Suecica*, 49: 1-144.

Hedberg, O. (1965). Afro-Alpine flora elements. *Webbia*, 19: 519-529.

Hedber, I. & Edwards, S. (eds) (1989). *Flora of Ethiopia.* Vol. 3: Pittosporaceae-Araiaceae. Addis Ababa and Asmara, Ethiopia, Uppsala, Sweden. 659 pp.

Hegazy, A.K. (1999). Deserts of Middle East. P. 360-364. In: Mares, M. A. (ed.), *Encyclopedia of Deserts.* Norman: University of Oklahoma Press. 645 pp.

Hegazy, A.K. ; El-Demerdash, M.A. &. Hosni, H.A. (1998). Vegetation species diversity and floeistic relations along an altitudinal gradient in South-west Saudi Arabia. *Journal of Arid Environments*, 38: 3-13.

Hemming, C.F. (1961). The ecology of the coastal area of northern Eritrea. *Journal of Ecology*, 49: 55-78.

Hosni, H.A. & Hagazy, A.K. (1996). Contribution to the flora of Asir, Saudi Arabia. *Candollea*, 51: 169-202.

Hepper, F.N. & Friis, I. (1994). *Flora Aegyptiaca-Arabica.* The plants of Pehr ForssKål's. Royal Botanic gardens, Kew, U.K. 400 pp.

Jackson, J.K. (1956). The vegetation of the Imatong Mtns., Sudan. *Journal of Ecology*, 44: 341-374.

Kassas, M. (1955). The mist oasis of El-Kwit, Sudan. *Journal of Ecology*, 44: 180-194.

Kassas, M. (1957). On the ecology of the Red Sea Coastal land. *Journal of Ecology*, 45: 187-203.

Kassas, M. & Zahran, M.A. (1967). On the ecology of the Red Sea littoral

REFERENCES

Abd El-Ghani, M. (1996). Vegetation along a transect in Hijaz mountains (Saudi Arabia). *Journal of Arid Environments,* 32: 289-304.

Abulfatih, H.A. (1979). Vegetation of higher elevations of Asir, Saudi Arabia. *Proceeding of Saudi Biological Societ,.* 3: 139-148.

Ali, M.M. ; Badri, M.A; Hassan, L.M. & Springuel, I.V. (1997). Effect of physiogeographical factors on desert vegetation, Wadi Allaqi Biosphere Reserve, Egypt. *Ecologie, t.* 28 (2): 119-128.

Arcotech (1994). Feasibility study on St. Catherine protectorate and Bardawil lagoon protected area; Sinai Egypt. Prepared for European communities, commission. P. 13-19.

Brooks, W.H. & Mandil, K.S.D. (1983). Vegetation dynamics in the Asir woodlands of south-western Saudi Arabia. *Journal of Arid Environments,* 6: 357-362.

Boulos, L. (1975). The Mediterranean element in the Flora of Egypt and Libya. 119-124. in: *La florae du bassin méditerraneen*: essai de systématique synthétique. Colloques Internationaux du C.N.R.S. No. 235, Paris.

Boulos, L. (1985). A contribution to the flora of Asir mountains, Saudi Arabia. *Arab Gulf Journal of Scientific Research,* 3: 67-94.

Boulos, L. (1995). *Flora of Egypt* Checklist. Al Hadara Publ. , Cairo, Egypt. 283 pp.

Boulos, L. (1997). Endemic flora of the Middle East and North Africa. P. 229-245. in (Barakat, H.N. & Hegazy, A.K. eds.): *Reviews in Ecology*: Desert conservation and development. Printed by Metropole, Cairo, Egypt.

Boulos, L. (1999). *Flora of Egypt.* vol. 1: Azollaceae-Oxalidaceae. Al Hadara Publ. Cairo, Egypt. 417 pp.

Boulos, L. (2000). *Flora of Egypt.* Vol. 2: Geraniaceae-Boraginaceae. Al Hadara Publ. Cairo, Egypt. 352 pp.

Braithwaite, C.J.R. (1987) Geology and palaeogeograpgy of the Red Sea region. P. 22-44. In: Edwards, A. j. & Head, S.M. (eds). *Red Sea.* Oxford: Pergamon Press. 441 pp.

Burger, W.C. (1967). *Families of flowering plants in Ethiopia.* Oklahoma, U.S.A. 231 pp.

Bussmann, R.W. (1994). *The forests of Mount Kenya (Kenya).* Vegetation, ecology, destruction and management of a tropical mountain forest ecosystem dissertation, University. Bayreuth, vol. 1: 177 pp., vol 2: Appendices, 53 pp. & vol. 3: Forest destruction and Management, 15 pp.

Chao, C. & Renvoize, S.A. (1989). A revision of the species described under Arundinaria (Gramineae) in southeast Asia Africa. *Kew Bulletin,* 44(2): 349-368.

Collenette, S. (1999). *Wild flowers of Saudi Arabia.* NCWCD, Riyad. 799 pp.

Cope, T.A. & Hosni, H.A. (1991). *A Key to Egyptian Grasses* Royal Botanic Gardens, Kew London, 75 pp.

Danin, A. (1983). *Desert vegetation of Israel and Sinai.* Cana Ltd, Jerusalem, Israel. P. 22.

Danin, A. (1986). Flora and vegetation of Sinai. *Proceeding of the Royal Society of Edinburgh,* 89B: 159-165.

Edwards, F.J. (1987). Climate and oceanography. P.45-70. In: Edwards, A. j.

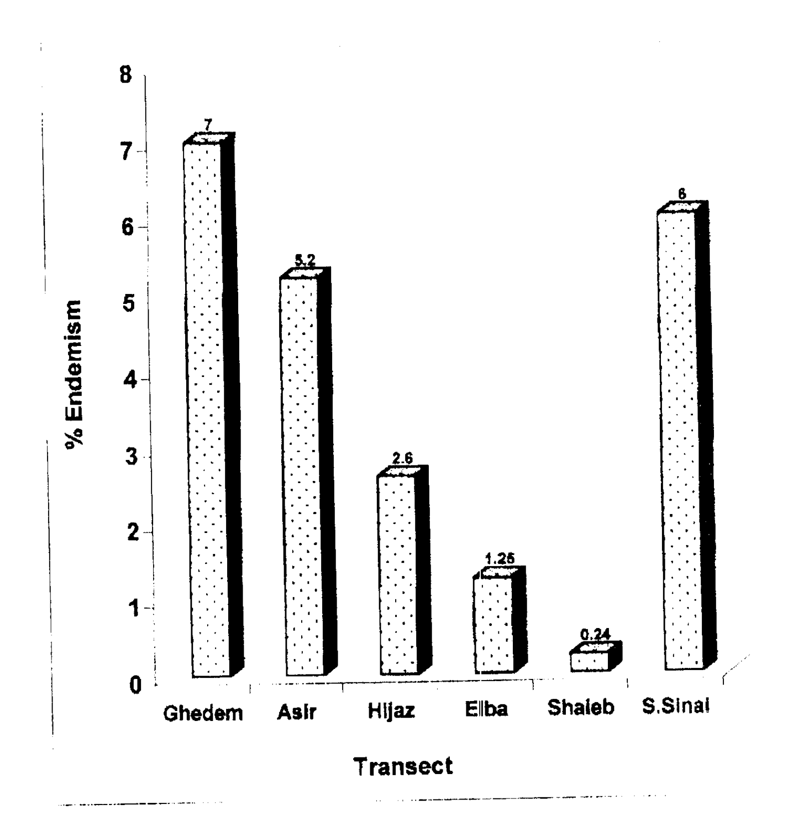


Figure 4. Percentage of endemism in the studied transects locality.

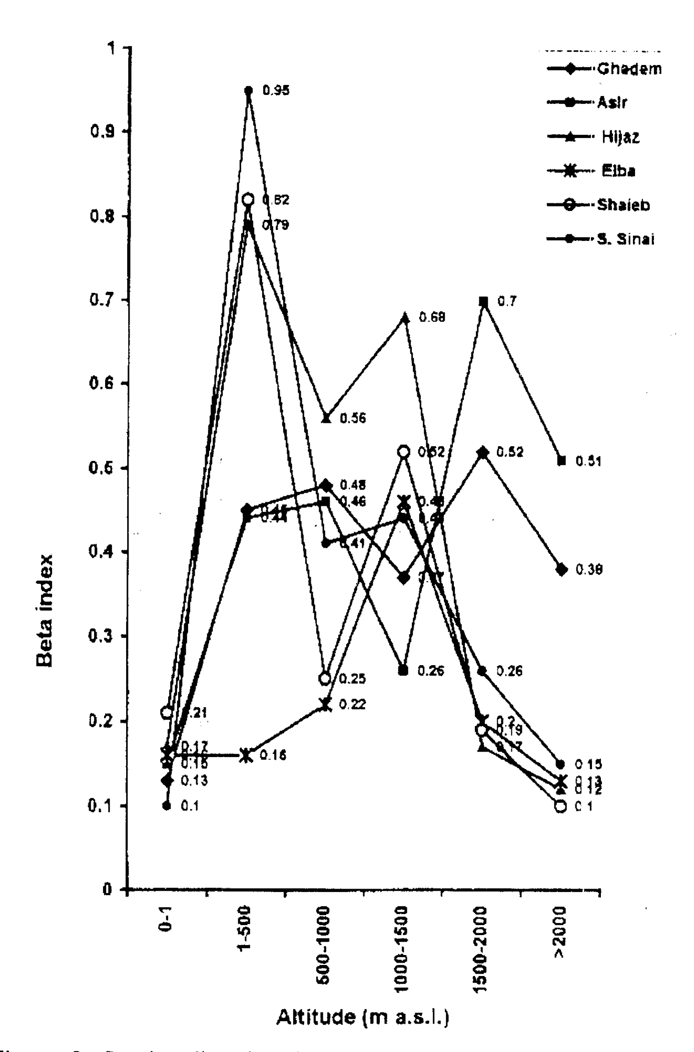


Figure 3. Species diversity along the altitudinal gradient of the studied transects locality. (Wilson and Shmida measure of beta diversity).

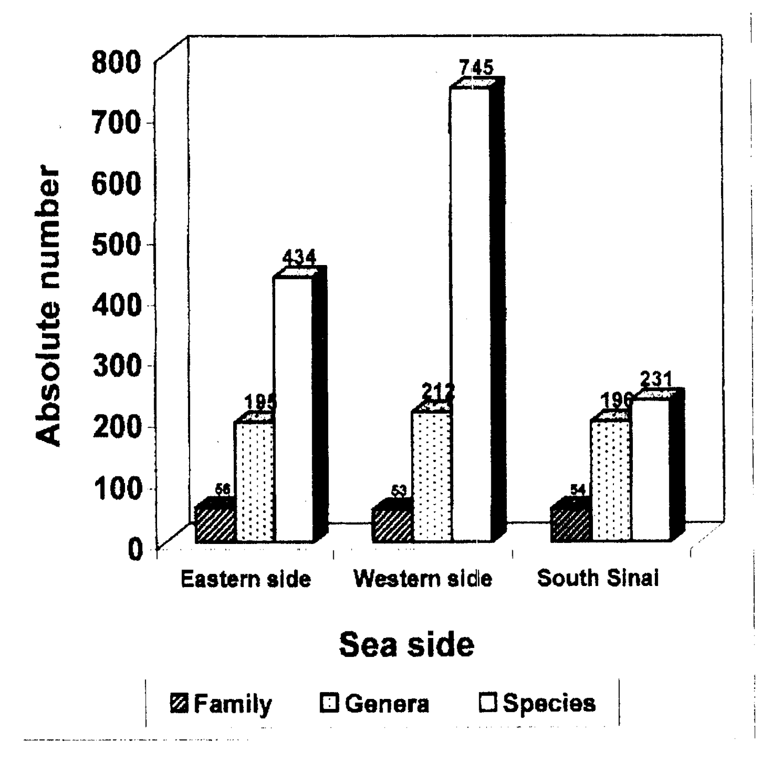
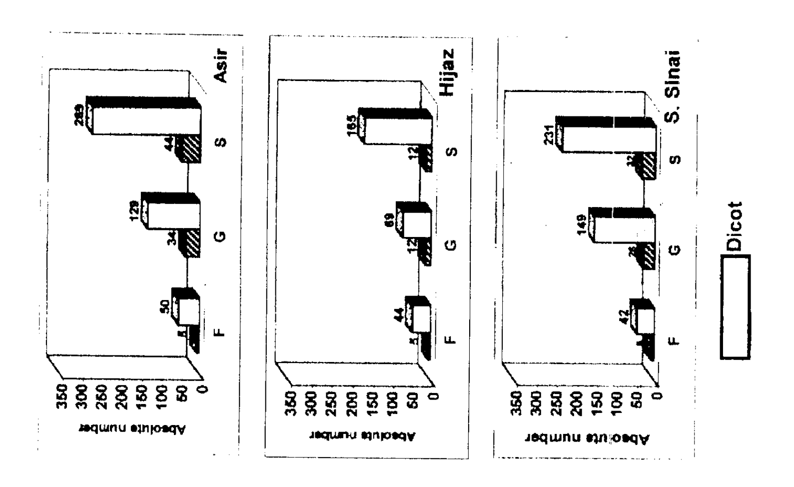


Figure 2. Total values of the floristic richness on both of Red Sea sides.



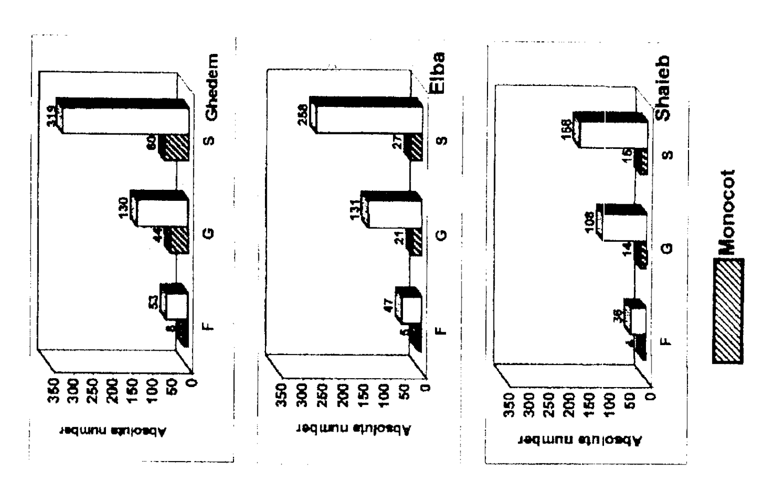
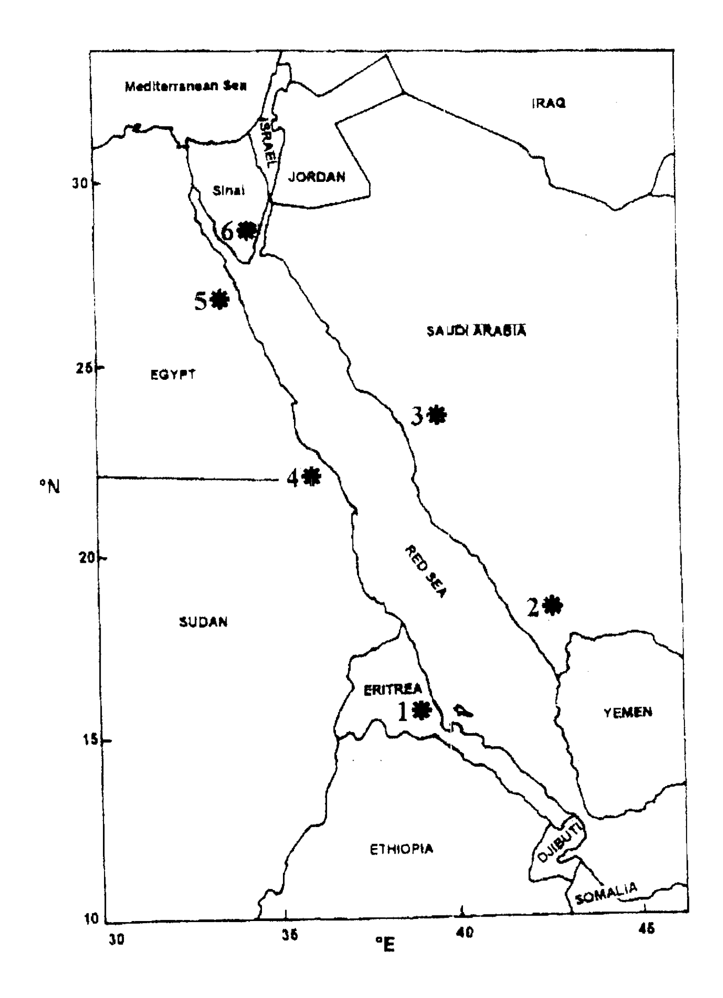


Figure 1. Floristic richness of the flora in the studied transects.
F. family, G. genera and S. Species.



Map 1. Location of the studied transects, on both sides of the Red Sea.
1. Ghedem, 2. Asir, 3. Hijaz, 4. Elba, 5. Shaieb and 6. South Sinai.

Table (1): Phytogeographical groups as percentages of the total number of species.

Phytogeographic region	Transect locality					
	Ghedem	Asir	Hijaz	Elba	Shaieb	S. Sinai
Uniregional						
Afro-Montane	11	1.50	-	-	-	-
Guineo-Congo	2.0	-	-	-	-	-
Mediterranean	-	-	-	0.95	3.10	3.28
Irano-Turanean	-	-	0.82	0.95	-	0.75
Saharo--Sindian	1.0	12.38	5.87	17.14	37.26	31.48
Sudano-Zambezian	58.5	36.99	30.57	28.47	3.34	1.0
Total uniregional	72.50	50.87	37.26	47.51	43.70	36.52
Biregional						
Med+Sah-Sind	-	11.06	5.78	5.71	11.18	14.10
Sah-sind+Sudano-Zamb	5.30	13.71	14.04	11.42	11.8	6.12
Med+IR-Tur	-	2.65	4.95	0.95	2.48	8.23
Med+Euro-sib	-	-	-	0.47	-	0.75
Sah-Sind+IR-Tur	-	3.53	9.91	8.57	14.90	9.04
Total biregional	5.3	30.95	34.68	29.52	40.36	38.24
Pluriregional						
Med+Sah-Sind+IR-Tur	-	0.44	4.13	2.85	5.59	7.30
Med+IR-Tur+Euro-Sib	-	-	-	0.47	-	1.25
Total pluriregional	-	6.19	9.91	10.47	13.04	14.1
Paleotropic	9.0	5.3	4.13	4.28	1.24	1.51
Pantropic	2.0	0.34	2.47	2.38	-	1.05
Cosmopolitan	3.0	2.21	4.13	1.9	1.40	2.5
Endemic	7.0	5.20	2.6	0.50	0.24	6.0
Others	1.2	0.03	4.82	3.44	0.02	0.08

phytogeographic region. This sector is characterized by the genera *Commiphora, Boswellia, Euphorbia* and *Dracena* genera and *Cometes abyssinica, Andrachne aspera* and *Argyrolobium arabicum* species.

(b) Middle sector of the Red Sea

The sector is represented by Elba and Hijaz transects. The flora is characterized by the dominance of Saharo-Sindian elements. Among the characteristic species are *Calotropis procera, Panicum turgidum, Cornulaca monacantha* and *Moltkiopsis ciliata*.

(c) Northern sector of the Red Sea

The sector is represented by Shaieb and South Sinai transects. The flora is characterized by the dominance of Saharo-Sindian elements. Dominant species as the middle sector. In addition to the presence of some Mediterranean elements among of them are *Asphodelus fistulosus, Astragalus cretaceous* and *Olea europaea* subsp. *cuspidate*, while Irano-Turanean elements represented by *Reseda stenostachya*.

The Coastal vegetation is almost similar on both sides of Red Sea with minor differences over several degrees of latitude, but the differences rapidly become apparent as one moves away from the sea and its immediate influence.

Acknowledgment

The authors thank Prof. Dr. M. Kassas and Prof. Dr. L. Boulos for their valuable comments on the manuscript.

The northern transects Shaieb and South Sinai are dominated by monoregional Saharo-Sindian chorotype: 37.26 % in Shaieb and 31.48 % in South Sinai. The high percentage of Saharo-Sindian elements is explained by the presence of Egypt in the middle of Saharo-Sindian region which extends from Morocco to South Iran and Iraq (Wickens, 1976).

The percentage of Sudano-Zambezian elements decreases northward from Elba to Shaieb and is replaced by Saharo-Sindian elements. These results are supported by the results obtained of Hassan (1987), who showed that the Sudano-Zambezian elements decreased in the Nubian desert where Saharo-Sindian elements dominate. Further north, Mediterranean elements are apparently well represented (El-Hadidi, 1993). This gradient corresponds to the pattern of precipitation (Ali, *et al* 1997), which gradually changes from predominantly winter rains in the north (Mediterranean type of climate) to predominantly summer rain (tropical type of climate) in the southern sector of the Red Sea.

CONCLUSIONS

The Red Sea is defined ecologically and floristically into three major sectors (southern, middle and northern sector). The floristic richness decreased from south to north direction and relatively increased in south Sinai. About 70 % of the flora are shared between the eastern and western sides. South Sinai is considered a tropical corridor for many tropical species. Some species are restricted to each side and each sector, while others are common and recorded in all studied localities.

The altitudinal gradient showed three main zones viz low, intermediate and high altitude. Vegetation in the intermediate altitude attains the highest species diversity.

Endemic species are rich in the southern Red Sea sector and decreases to minimum in the middle sector and again increases in the northern sector namely South Sinai transect which represents the tropical corridor. Southern sector is characterized with a few endemic families and large number of endemic species, for example, *Caralluma penicillata, Achillea arabica* and *Pulicaria schimperi*. Middle sector is characterized by absence of endemic families and presence of a small number of endemic species. The endemic species in the northern sector showed Mediterranean and Irano-Turanean affinities. Among the endemic species are: *Arabidopsis kneuckeri, Silene schimperiana, Bufonia multicepes, Phlomis aurea* and *Astragalus camelorum*.

In general the Red Sea is defined ecologically and floristically into three major sectors.

(a) Southern sector of the Red Sea

This sector is represented by Ghedem and Asir. The two representative transects showed the dominance of Sudano-Zambezian elements which is explained by the position of this sector within the Sudano-Zambezian

Arabian domain which is also a subregion of Sudano-Zambezian region. Sudano-Zambezian region is characterized by a few endemic families and a few endemic genera such as *Keniochloa* (Gramineae), *Oreophyton* (Cruciferae), *Haplosciadium* (Umbelliferae) and *Dianthoseris* (Compositae) and a large number of endemic species such as *Caralluma penicillata* and *Achillea arabica*.

Hijaz and Shaieb transects lie in the core of Saharo-Sindian region, both of transects containing low percentages of endemic species (2.6 % and 0.24 %; respectively). The low percentages of endemic species in these transects is referred to Wickens (1976), who suggests that the Saharo-Sindian region is characterized by the absence of endemic families and the presence of a small number of endemic genera and a few endemic species. Sinai flora containing about 36 endemic species, most of them are confined to the mountain region (El-Hadidi, 1969). Danin (1986) mentions that the number of endemic species and subspecies in Sinai is 28 that comprises 3.2 % of the total Sinai flora. While, Boulos (1995) notes that the number of endemism in Sinai is 33 species; four of them are sub-endemic species (Known from other regions in Egypt). Gibali (1988) cited that the number of endemic species in Sinai is 33 species 9 of them is endemic to North Sinai and 24 in South Sinai. Sinai endemic species comprises 60.7 % of the total Egyptian endemic species among of them: *Arabidopsis kneuckeri, Silene schimperiana, Bufonia multicepes, Phlomis aurea* and *Astragalus camelorum*.

The high endemic species in Ghedem, Asir and South Sinai transects is supported with Boulos (1997), who cleared that the endemic flora is highly represented in Islands, Peninsulas and mountain chains. Labiatae, Leguminosae, and Compositae are families with highest number of endemic species in South Sinai transect. Asclepiadaceae, Liliaceae and Euphorbiaceae are families with high endemic species in Asir transect. One crucifer is the only endemic species in Egyptian part of the Elba mountain group.

Chorological analysis

The southern transects namely Ghedem and Asir are dominated by monoregional Sudano-Zambezian chorotype elements. It is represented by 58.5 % and 36.99 % ; respectively of the total species. The dominance of Sudano-Zambezian chorotype species is supported by White & Leonard (1991) suggestion about the extension of Sudano-Zambezian region to South Arabia known as South Arabian domain. Also Ghedem belongs to the same phytogeographic region and lies in the core of Afr-Oriental domain of the region (Wickens, 1976).

Middle transects namely Elba and Hijaz transects are also dominated by Sudano-Zambezian chorotype: 30.57 % in Hijaz and 28.47 % in Elba. Elba flora is codominated by Saharo-Sindian chorotype (17.14 %). Hijaz flora is codominated by the Saharo-Sindian+Sudano-Zambezian biregional chorotype.

Among the common species recorded in the six studied transects are: *Panicum turgidum, Blepharis edulis, Aerva javanica, Aizoon canariense, Calotropis procera, Heliotropium arabinese, Citrullus colocynthis, Anastatica hierochuntica, Lavandula coronopifolia, Acacia enhrenbergiana, Acacia tortilis, Stipagrostis plumos, Caylusea hexagyna* and *Forsskaolea tenacissima.*

The floristic richness in the eastern and western Red Sea sides as based on the studied transects reveals about 110 species common to both sides of which are: *Abutilon fruticosum, Acacia tortilis, Anastatica hierochuntica, Capparis deciduas , Lavandula pubescens, Leptadenia pyrotechnica, Moringa peregrina, Panicum turgidum, Pistacia khinjuk, Stipagroatis plumosa, Ruellia patula, Asphodelus africanus, Echium longifolium* and *Cometes abyssinica.*

Species diversity

Altitudinal variation is a major factor affecting the distribution of plant species and communities (Abd El-Ghani, 1996 & Hegazy, *et al* 1998). Vegetation studies of the six selected transects revealed that plant communities changed from one altitudinal belt to the next with broad transitional areas and overlap between low and high altitude vegetation. Similar results and observations were described by Kassas (1955) in Sudan, Vesey-Fitzgerald(1955) in Saudi Arabia, Kassas (1957) in Egypt, Brooks & Mandil (1983) in Saudi Arabia, Ghazanfar (1991) in Oman, Hegazy, *et al.* (1998) in Saudi Arabia, and Vetaas (1992) in Sudan.

Wilson and Shmida measure of beta diversity reveals that the highest species diversity are found in the altitudinal range from 500-2000 m a.s.l. Similar observation was also found by Hegazy, *et al* (1998) in south-west Saudi Arabia. This observation explained by (Arcotech, 1994), who pointed out that the intermediate ridges are characterized by deep alluvium and loose deposits covered by fissured rocks, cobbles and stones. Deep deposits have a greater capacity for water storage than the terraces, providing better chance for vegetation growth.

This study revealed that the species diversity attained the highest values at the intermediate elevations decreased towards highlands (>2000 m a.s.l.) and lowlands (0-1 m. a.s.l.). The highest species diversity in southern Red Sea transects represented by Ghedem and Asir is in the altitudinal range of 1500-2000 m a.s.l. While in northern transects represented by Hijaz, Shaieb and S. Sinai attained the highest species diversity in the altitudinal range of 1-500 m. a.s.l. except Elba transect, the highest species diversity is in the altitudinal range of 1000-1500 m. a.s.l.

Endemism

Ghedem transect belongs to Afr-Oriental domain of Sudano-Zambezian region. The flora of this transect characterized by 7 % endemic species, it is the highest percentage of endemism among the studied transects. The flora of Asir transect attained 5.2 % endemic species. This transect belongs to South

Halopyrum mucronatum (Gramineae) has an extensive distribution on maritime sands from East Africa northward to Somaliland, Eritrea, Sudan and Egypt to about 30 km north of Mersa Halaib at 22° N (Kassas & Zahran, 1967).

Mangrove vegetation in the western Red Sea side is dominated by *Avicennia marina*. It dominates the Eritrean coast, northward *A. marina* is associated with *Rhizophora mucronata* South of Suakin (19° 15′-19° N) in the Sudanian coast. *Avicennia marina* dominats the more northern coasts till mixed with *Rhizophora mucronata* near Halaib at 23° N on the Sudano-Egyptian border. The northern limit of *A. marina* is Moys Hormos Bay near Hurghada at 27° 14′ N. In addition to *A. marina* stand reported in Gulf of Aqaba (tropical corridor), South Sinai at 27° 40′ N. In the eastern coast *Avicennia marina* pure communities dominant the coast of Yemen, and northward in Saudi Arabia to Jiddah; except individual trees of *Rhizophora mucronata* are associated with *A. marina* in Jizan swamps. Northern of Jiddah scattered shrubs are noticed at 90 km, 160 km and 520 km north of Jiddah. The northern limit of mangrove in the eastern Red Sea side is at 27° N, opposite to Moys Hormos in the western side (Hemming, 1961; Kassas & Zahran, 1967; Zahran, 1977 & 1983 and Edwards & Head, 1987).

The investigated localities are compared; we note in Ghedem transect, Gramineae, Compositae and Euphorbiaceae are the families having the highest species richness; *Senecio, Lobelia* and *Alchemilla* are the common genera. In Asir and Elba transects Gramineae, Leguminosae and Compositae are the families with the highest species richness. *Acacia, Euphorbia* and *Solanum* are genera with high number of species in both of Asir and Elba transects. Hijaz and Shaieb transects showed lower floristic richness compared to the previous transects. Again Compositae, Leguminosae and Gramineae are the families with the highest species numbers. The common genera in Hijaz are *Heliotropium, Acacia* and *Fagonia,* while in Shaieb *Cleome, Astragalus* and *Fagonia* are the common genera. The same three families are represented with high numbers in South Sinai, while *Astragalus, Silene* and *Erodium* are the genera represented with high species numbers.

The relatively high number of species in South Sinai may be attributed to its position as a tropical corridor and as a point of intersection for four biogeographical regions: Mediterranean, Irano-Turanean, Saharo-Arabian, and Sudanean (Hegazy, 1999). These regions give South Sinai its rich floristic and biological diversity. Also the mountain area receives sporadic precipitation about 50 mm/year and extra rain up to 300 mm occurs in higher altitudes due to orographic influence and snow falls occasionally at altitudes above 2000 m a.s.l. (Arocotech, 1994). Nearly every shower becomes available to the plants growing on mountain crevices and soil pockets (Danin, 1986). Runoff water enhancing dense wadis vegetation, lowlands of 0-1 m a.s.l. characterized by halophytic vegetation. Among the tropical species to the South Sinai are *Acacia tortilis, Avicennia marina, Hyphaene thebaica, Moringa peregrina, Salvadora persica* and *Suaeda monoica*.

The floristic affinity of the Red Sea vegetation shows the dominance of monoregional chorotype over the other chorotypes. Sudano-Zambezian chorotype dominats the southern Red Sea vegetation. This type decreased northwards and is replaced by the Saharo-Sindian chorotype till it reaches the Mediterranean and Irano-Turanean regions in more northern parts.

DISCUSSION

Ecologically and floristically the present work fairly defines the Red Sea region into three phytogeographical sectors: (a) the southern sector that is distinct with copious summer rain ; (b) the middle sector, virtually rainless or receives a few millimeters in some localities ; and (c) northern sector that is affected by the Mediterranean with its rainy winter and dry summer. The continuous south- to- north extension of the principal habitat types on both sides that include the littoral habitats, coastal plains and mountain escarpment represent an important link that strengthen the floristic relationship in the region. The south- to- north extension of both sides of the sea acted as a migration route between the Mediterranean and Tropical flora (Wickens, 1976).

Floristic richness

Floristic analysis demonstrated the existence of very strong relationship between the flora of the two sides of the Red Sea. The species shared in the eastern and western sides constitute about 70 % of the total flora. About 5o % of the total flora on both sides are found in South Sinai among of them: *Panicum turgidum, Stipagrostis plumosa Blepharis edulis, Aerva javanica, Aizoon canariense, Calotropis procera, Heliotropium arabinese, Citrullus colocynthis, Anastatica hierochuntica, Lavandula coronopifolia, Acacia enhrenbergiana, Acacia tortilis, Echinops spinosus, Iflago spicata. Pulicaria undulata* and *Forsskaolea tenacissima.* This strong floristic relationship between the two sides seems to be attributed to the previous possible same origin as exhibited by the part played by the breaking off the land continuity that existed previously. It is a fact that the Arabian Peninsula was geologically and geographically part of Africa (Furon, 1963 and Edwards & Head, 1987).

Floristic richness revealed that the number of species in the western side is greater than that of the eastern side. Considering the restricted and common families to both sides of the Red Sea we find Gramineae, Leguminosae and Compositae are the major families met in both of the Red Sea sides as well as South Sinai. Aristolochiaceae and Dipsacaceae are restricted to the eastern side. Actiniopteridaceae is restricted to the western side. Aspleniaceae and Globulariaceae are restricted to South Sinai. As a common observation the number of salt tolerant species is 57 in the western side, 40 in South Sinai and 19 in the eastern side of Red Sea. The presence of salt tolerant species is linked with the width of the coastal plain that increases with the increase of the coastal width.

c. Endemism

The percentages of endemic species in the flora of the studied transects is shown in figure (4). Ghedem (most southern transect) and South Sinai (most northern transect = tropical corridor) show the higher percentages of endemism amounted (7 % & 6 % ; respectively). In Ghedem endemic species mostly belong to four genera: *Keniochloa* (Gramineae), *Oreophyton* (Cruciferae), *Haplosciadium* (Umbelliferae) and *Dianthoseris* (Compositae). Other endemic plants such as *Caralluma penicillata* and *Achillea arabica* are also among the endemics. In South Sinai endemic species are represented by 24 including: *Arabidopsis kneuckeri, Silene schimperiana, Bufonia multicepes, Phlomis aurea* and *Astragalus camelorum.*

Shaieb transect is represented by the lowest percentage of endemic species (0.24 %). This percentage includes the two species *Colchicum cornigerum* and *Crepis aegyptiaca*. *Biscutella elbensis* (Cruciferae), the only endemic species in Elba mountain transect, belongs to the Egyptian sector. Percentage endemism in Asir transect amounts 5.2 %. This value is represented by 11 species, among them: *Caralluma penicillata. Achillea arabica, Senecio odorus* and *Lavandula citriodora.* Two endemic species were traced in Hijaz mountain transect that represent 2.6 % of the total recorded species.

d. Floristic relations

Results in Table (1) indicate that the uniregional Sudano-Zambezian chorotype dominates the southern Red Sea sector as represented by Ghedem and Asir transects. This chorotype comprises 58.5 % and 36.99 % of the total species in each transect. Ghedem flora is associated with 11% Afro-Montane elements while flora of the slightly northern transect (Asir) is associated with the biregional Saharo-Sindian+Sudano-Zambezian chorotype, which represent, 13.71 % of the total species in the investigated transect.

The middle sector of Red Sea as represented by Hijaz and Elba transects are dominated by Sudano-Zambezian chorotype that includes 30.57 % in Hijaz and 28.47 % in Elba transect. Hijaz flora is codominated by the Saharo-Sindian+ Sudano-Zambezian chorotype (14.04 %), while Elba flora is codominated by Saharo-Sindian chorotype (17.14 %).

The northen sector of Red Sea as represented by Shaieb and South Sinai transects are dominated by Saharo-Sindian chorotype. Shaieb flora is characterized by 37.26 % Saharo-Sindian elements and about 11 % of the biregional Saharo-Sindian+Mediterranian elements with Saharo-Sindian+Sudano-Zambezian elements. South Sinai (the most northern transect) shows the dominance of Saharo-Sindian chorotype (31.48%) and codominance of Mediterranean +Saharo-Sindian chorotype (14.10 %). True Mediterranean (3.28 %) elements and Saharo-Sindian+Irano-Turanean elements (9.04 %) are also represented in the floral skeleton of S. Sinai transect.

Jatropha villosa).

The flora of the middle Red Sea sector (Fig. 1) as represented by Elba and Hijaz transects contain low number of monocot species compared to the southern sector. The southern transects are dominated by family Gramineae (e.g. *Panicum turgidum, Stipagrostis plumosa* and *Lamarckia aurea)*. Dicots are moderately represented; and appear higher in Elba transect than Hijaz transect and families dominated by Leguminosae (e.g. *Astragalus vogelii, Acacia tortilis* and *Indigofera spinosa*); Compositae (e.g. *Pulicaria crisipa, Iflago spicata* and *Centaurea aegyptiaca*) and Cruciferae (e.g. *Zilla spinosa, Farsetia longisiliqua* and *Anastatica hierochuntica*).

While the northern Red Sea sector (Fig. 1) as represented by Shaieb and South Sinai transects shows the lowest number of monocot species among the investigated transects. South Sinai transect contain higher dicot species than that in Shaieb. Monocots are dominated by Gramineae (e.g. *Panicum turgidum, Lasiurus scindicus* and *Stipagrostis pulmosa*). Dicots are dominated by Leguminosae (e.g. *Acacia tortolis, Astragalus spinosus* and *Retama raetam*); Compositae (e.g. *Pulicaria crispa, Launaea spinosa* and *Seriphidium herba-alba)* and *Cruciferae* (e.g. *Zilla spinosa, Diplotaxis harra* and *Matthiola logipetala*).

Figure (2) outlines the families, genera and species number collectively on the eastern and western sides as well as in South Sinai. The number of species in the investigated transects in the western side reached 745, while in the eastern side and South Sinai transects amounted 434 and 231; respectively. The number of genera reached 212 in the western Red Sea side, 195 in the eastern side and 196 in South Sinai transect. The number of families was almost equal, in western side, eastern side and South Sinai transect and ranged between 54 in South Sinai and 53 in western side of the sea. Species diversity is in the similar pattern.

b. Species diversity

Analysis of species diversity along the altitudinal gradient in the study localities is shown in figure (3). Considering the overall site specific diversity, the two southern most sites namely Ghedem and Asir and the southern Sinai mountains show higher diversity than the remaining three sites. The altitudinal species diversity demonstrated an irregular pattern of variation among the different altitudinal belts in all study localities. The lowest species diversity values are found in the littoral habitats around the sea level (0-1 m a.s.l.). The highest species diversity is recorded in the altitudinal belt of 1500-2000 m a.s.l. in Ghedem and Asir mountains, while the coastal plains in the altitudinal belt 1-500 m a.s.l. in the remaining four study localities attain the highest species diversity values in the range of 0.79-0.95. Plant communities in the littoral habitats share a few number of species with the coastal plain habitats (1-500 m a.s.l.), while plant communities at altitudinal belt higher than 500 m a.s.l. share high number of species. This hold, true for all study localities.

Data for the three sites namely Hijaz. Ghedem and Elba mountain groups were compiled from the literature and flora of the concerned countries and its surroundings (Abd El-Ghani (1996); Boulos (1975, 1999 & 2000); Burger (1967); Bussmann (1994); Collenette (1999); Danin (1986); El-Hadidi & Hosni (1996); Hedberg (1951 & 1965); Hedber & Edwards (1989); Hepper & Friis (1994); Jackson (1956); Mighahid (1988-1990); Ozenda (1977); Quézel (1978); Täckholm (1974); Teketay (1995); White (1950) and Zohary (1972).

The phytogeographical treatment of the floristic elements followed Wickens (1976); Hosni & Hegazy (1996) and White & Léonard (1991). Species identification followed: Abd El-Ghani (1996); Abulfatih (1979); Boulos (1985, 1995, 1999 & 2000); Burger (1967); Chao & Renvozi (1989); Cope & Hosni (1991); El-Hadidi (1969); Fayed & Zayed (1989); Gibali (1988); Hassan (1987); Hosni & Hegazy (1996); Hedberg (1951 & 1965); Hepper & Friis (1994); Mighahid (1988-1990); Täckholm (1974) and Teketay (1995).

Floristic richness and species diversity in the different localities were analyzed. Species diversity index was determined in the different altitudinal belts of every locality. The beta diversity index ($?_t$) was calculated from Wilson & Shmida's measure (Wilson & Shmida, 1984) by adding the number of the gained species g(H) encountered along the altitudinal transect, to the number of species lost l(H) over the same transect, and the standardization by the mean species richness (?) according to the following formula:

$$?_t = [g(H)+l(H)]/2?$$

The fewer species that the different communities or habitats (gradient position) share, the higher the beta diversity.

RESULTS

a. Floristic richness

A total of 1310 species were recorded from the six studied mountain transects. Fig. (1) shows the number of families, genera and species. The total number attained the highest values in the southern transects namely Ghedem and Asir. The number of species decreased towards the middle sector which is represented by Elba, Hijaz and Shaieb mountain groups, and increased again in the northern sector represented by South Sinai mountain transect. In all transects the dicot species, genera and families were higher than monocots.

In the southern Red Sea sector, monocots are highly represented by the family Gramineae (e.g. *Aeluropus lagopoidus*, *Cenchrus ciliaris*, and *Lamarckia aurea*). Dicot families are dominated by Compositae (e.g. *Psiada arabica*, *Euryops arabicus* and *Bidens bipinnata*); Leguminosae (e.g. *Agrolobium arabicum*, *Acacia mellifera* and *Acacia enhrenbergiana*) and Euphorbiaceae (e.g. *Andrachne aspera*, *Euphorbia schimperiana* and

Climate

The climate varies from very hot and dry in the littoral and coastal plains to wet and cold and mostly foggy at high altitudes in the mountain belts. The distance between the sea and the mountain escarpment is an important factor affecting the climate in the different localities. There are some seasonal climatic differences between the southern and the northern parts, but both eastern and western sides are overwhelmingly arid.

The Red Sea region experiences some of the hottest and most arid conditions on earth. To the west stretches the almost rainless North African desert. Eastwards and north-eastwards desert and semi-desert extend even further through Arabia to central Asia. To the north lies the Mediterranean with its winter rain and summer drought. To the south, the copious summer rainfall of the Ethiopian highlands remains distant, and only alternating summer and winter monsoons, barely penetrates to the southern extremities of the Red Sea basin.

Rainfall over the region is sparse, sporadic and very localized. A particular location may receive no rain for years, then to experience a brief heavy rainfall which may then not be repeated for a similar lengthy period. In the Gulf of Suez and Aqaba, rain amount to about 25 mm/year. The western side, from Hurghada to about 22° N is virtually rainless, with any specific area only receiving few millimeters at intervals of several years. This is probably also true for the eastern side-south of 22° N at Dungunab the mean annual rainfall is about 40 mm, but Port Sudan it is about 100 mm and at Suakin, at 19° N, it reaches about 180 mm. Jiddah on the eastern side, averages about 50 mm/year with some heavy outbreaks of rain south of Jiddah. Further south in the western side from Massawa towards the Strait, the average rainfall is about 180 mm/year. This is true from the coastal belt on the eastern side from Jazan region towards the Strait. Much more rainfall is expected at the high elevations in the mountain belts of the eastern and western sides. Orographic precipitation is more pronounced on the slopes of the high mountains. For more environmental settings of the region see Edwards (1987).

METHODS

For the field survey of Asir, Shaieb El-Banat and South Sinai, the study sites were selected along a transect from the Red Sea coast and extending landward through the littoral habitats and the coastal plains to the mountain escarpment. Five altitudinal belts were recognized: 0-1, 1-500, 500-1000, 1000-1500, 1500-2000 and >2000 m a.s.l. Altitudes were determined by altimeter readings adjusted for regular daily fluctuations of temperature and air pressure in every locality. A floristic list was recorded for every altitudinal belt. Plant specimens were collected and identified in Cairo University (CAI) and Agricultural Museum (CAIM) herbaria. Voucher specimens were deposited in CAI.

this study is to analyze the species diversity, chorology, and floristic relations at both altitudinal (sea landwards) and latitudinal (south to north) levels on both sides of the sea. The study provides an analysis into which further more detailed ecological and taxonomical studies may be fitted.

Study area

Six major localities (Map 1) are selected for this study including:

1- Ghedem mountain group on the eastern Eritrean coast (15° 20'- 15° 40' N), with maximum elevation 3054 m a.s.l.
2- Asir mountain group, South-West Saudi Arabia (16°-19° N), with maximum elevation exceeds 3000 m a.s.l.
3- Hijaz mountain group, West Saudi Arabia (21° 30' – 24° 30' N), with maximum elevation 2500 m a.s.l.
4- Elba mountain group at Sudano-Egyptian border (22°-23° N) with maximum elevation 2216 m a.s.l.
5- Shaieb El-Banat mountain group, Egypt (26° 30'- 27° 30' N), with maximum elevation 2184 m. a.s.l.
6- South Sinai mountain group between Gulf of Suez and Aqaba, Egypt (27° 45' - 28° 45' N), with maximum elevation 2642 m. a.s.l.

Data of Hijaz, Ghedem and Elba mountain groups are compiled from the literature, while data of the remaining three localities are based on field and literature surveys. The field work was carried out during the years 1997-2001.

Geology

The Red Sea lies between the African and Arabian plates and is essentially a product of their divergence. The Sea cuts across Pre-Cambrian (700 Ma old) basement rocks of the Sudan and Saudi Arabia which were once united. It was established as a linear trough about the Oligocene period (38 Ma ago). Deposition during the Miocene period (25-5 Ma ago) was dominated by salt deposits in the central region, with transitions to marginal carbonates and siliciclastic deposits derived by erosion from the rising mountain fronts (Braithwaite, 1987). Rift movements appear to have been reduced during the Miocene but they began again about 5 Ma ago with the margins of the depression moving apart at about 0.9 cm/ year per flank. The fault-bounded escarpments formed have exposed Miocene salt deposits and black shales rich in heavy metals, Pliocene, Pleistocene and Recent sediments from a relatively thin cover along the margins within which lavas and igneous intrusions are common. The coastal margins are characterized by multilayered Pleistocene and Recent sediments. These rang from screes and wadi deposits, through alluvial fans and siliciclastic plain deposits, flowing from the mountain front, to reefs and associated bioclastic deposits.

Detailed description of the study localities are found in Nebert (1970), Linddicoat (1971), Zahran (1983), Edwards & Head (1987), Springuel (1997) and Hegazy, *et al.* (1998).

INTRODUCTION

The Red Sea is 1932 km long,and averageof 280 km in width. At its widest, in the south near Massawa, it is reaches 354 km wide and this narrows to 29 km at Strait of Bab al Mandab and to about 180 km before it branches to the Gulf of Suez and the Gulf of Aqaba. The latitudinal range of the Sea lies between 30° N and 12° 30' N, it has a long history in association with man's activities, but the degree of human impact and exploitation has until recently been negligible.

Though it is not classified under a "key environment" region (*sensu* Head, 1987), the Red Sea has very rich and varied environment. Compared with many other tropical and subtropical seas, the high susceptibility to misuse and the obvious vulnerability of the Red Sea qualifies it for " key environment" status. Concerning its coastal flora, both sides of the Red Sea encompass a highly spectacular flora and interesting plant communities. The region is valued for its unique environment, high diversity, great scientific and ecological importance. With its north-to-south and sea-to-land gradients of the physical conditions, it offers a great scope for floristic richness and diversity.

The Red Sea region is interesting from the floristic and phytogeographic point of view because of its relation to the neighboring regions of Africa and Asia. The rugged topography and inaccessibility of the mountainous escarpments of this region have resulted in a paucity of extensive or intensive floristic studies in general and its altitudinal diversity in special. Being diverged from the same origin by the Red Sea trough, the eastern and western sides are described as adjacent, and hence the observed continuity of the floristic elements.

Both sides of the Red Sea comprise three principal habitat types that include (a) The littoral habitats with its diverse coral edges, sandy beaches, mangrove wetlands and salt marshes. (b) The coastal plains that lie between the littoral zone and the mountain escarpment. These plains consist of sandy and/or stony deposits mainly derived from the mountain zone. A sub-coastal plains may occur and are central between two hill masses in an intermediate range of hills. (c) The mountain escarpment which can be differentiated into hill massif and mountain range. The hill massif may begin from the sea shore or from up to 80 km from the sea as in the Jizan region, south-west Saudi Arabia. The hill massif rises to about 500 m a.s.l. The mountain range extends parallel to the coastal with elevations from around 500 m to more than 3000 m a.s.l. in the highest peaks. The continuous range of the mountain escarpment forms a natural divide between seaward drainage to the Red Sea and landward drainage to the mainland. The three habitat types are traversed by wadis (drainage system) that are deeply incised into the coastal plains and their flood waters seldom reaches the sea, as they are gradually absorbed by the sandy substratum.

The continuous south-to-north extension of the coastal plains and mountain ranges on both sides of the Red Sea represent an important link which strengthen the floristic relationships in the region. The purpose of

ALTITUDINAL AND LATITUDINAL DIVERSITY OF THE FLORA ON THE EASTERN AND WESTERN SIDES OF THE RED SEA

Ahmad K. Hegazy * and Wafaa M. Amer

Department of Botany, Faculty of Science, Cairo University, Giza 12613,
(* Author for correspondence).

ABSTRACT

The coastal lands comprise three principal habitat types: coastal marshes (mangrove and littoral salt marshes), coastal plains and mountains. The variations in topography and elevation have resulted in distinctive vegetation zones and species diversity along the latitudinal and altitudinal gradients. The altitudinal gradient starts from sea level to the highest peaks along the sides of the sea. The study of floristic richness and species diversity is interesting from the floristic and phytogeographic point of view because of its relation to the neighboring regions of Africa and Asia. The present study focuses on six major localities namely: Ghedem mountain group in Eritrea, Asir mountains and Hijaz mountains in Saudi Arabia, and Elba, Shaieb El-Banat and South Sinai mountain groups in Egypt. Data of Ghedem, Hijaz and Elba mountains are complied from the literature, while data of the remaining three localities are based on field survey and literature. Species diversity and floristic relations were analyzed at low, intermediate and high altitudes at both altitudinal (sea landward direction) and latitudinal (south to north direction) levels. The lowest values were recorded in the coastal marshes is recorded. An increase in diversity in the coastal plain habitats is recorded. The highest species diversity was recorded at the altitudinal range of 1500 - 2000 m a.s.l. in the southern mountains, and around 500 to 1000 m a.s.l. in the northern mountains. This was followed by a decrease in the species diversity at the subsequent higher altitudes. The high altitude restricted floral elements and the altitudinal belts of the vegetation are more pronounced in the southern mountains than in the northern mountains on both sides of the sea. Different vegetation zones show a decreased species diversity in the northward direction. Broad transitional areas and overlap between many species characterize the transitional range between plant communities in the south-to-north direction before they fully replace each other. The Red Sea region represents a point of interaction of two major biogeographic regions: the Sudano-Zambezian and Saharo-Sindian. Which give the Red Sea its floral diversity. Similarities and differences between the eastern and western sides of the sea are reviewed and discussed.

الكساء الخضرى الطبيعى وتنمية البيئة الصحراوية فى مصر : دراسة بينية

محمود عبد القوى زهران

استاذ البيئة النباتية المتفرغ

قسم النباتات- كلية العلوم – جامعة المنصورة – المنصورة – مصر

ملخص

الكساء الخضرى الطبيعى لصحارى مصر الساحلية والداخلية تتصف بعدد كبير من الأنواع النباتية المتحملة للملوحه والجفاف وقد أثبتت الدراسات البيئية أن كثير من هذه النباتات يمكن أن يلعب دوراً هاما فى تنمية الصحارى .

يلقى البحث الضوء على نتائج عدد من المشاريع العلمية التى قام بتنفيذها المؤلف وذلك منذ أكثر من ٢٥ عاما والتى تهدف الى استخدام الانتاج الخضرى لبعض من الانواع النباتية الصحراوية كمادة خام تستخدم فى إنتاج ورق الطباعة واعلاف الحيوانات وهذه الانواع هى : السمار المر بنوعيه ربيجيداس وأكيوتاس (نباتات الياف) والأكاسيا ساليجنا والقطف نوعى الها ليماس والنيبوميولاريا ، والخلين والكوخيا إنديكا ، وأبو نعجة ، والنسيله والسمار الحلو نوع اسكيرباس ليتولاريز (نباتات اعلاف) .

اكدت نتائج التجارب الحقلية التى أجريت بالصحارى الساحلية بالدلتا وتحاليل النباتات المعملية وتغذية الحيوانات وكذلك تجارب إنتاج الورق بشركة الورق الأهلية ما يلى :-

نباتات السمار المر نوعى ريجيداس واكيوتاس وكذلك نبات الكوخيا إنديكا يمكن زراعتها كمحاصيل غير تقليدية فى الاراضى الملحية . ٢) الانتاج الخضرى لنوعى السمار المر أنتج ورق طباعة جيد . ٣) كل نباتات الأعلاف التى تمت تم تحليلها غنية بالمادة الغذائية الضرورية للحيوانات . ٤) الحيوانات التى تمت تغذيتها بثلاث انواع من نباتات الأعلاف (الأرانب تغذت على نباتات الخلين وأبو نعجة والخراف تغذت على نباتات الكوخيا إنديكا) ، زادت اوزانها دون أية اعراض جانبية ضارة .

يستنتج من هذه الدراسة أن تنمية الصحارى المصرية زراعيا وصناعيا يمكن أن يعتمد بدرجة كبيرة على الثروة النباتية الطبيعية للنباتات المتحملة للملوحة والجفاف فى تلك الصحارى .

REFERENCES

Boyko, H. (1966). Basic principles of plants grow lug by irrigation with highly saline water or sea-water.In: Boyko H. (ed.) Salinity and Aridity, Dr. W. Junk, The Hague: pp 131 - 200.

Mansour, F.A. (1992). Role of gypsum and bacteriological activities on reclamation of the salt affected lands of the deltaic Med. coast, Egypt. Project No. 90009, PhaseJI Final Report. FRCU Supreine Council of Egyptian Universities, Cairo: 74 - 1 89.

Meshrif, H. (1990). Soil Survey. In: Report entitled. Revegetation of The Salt Affected lands, of the deltaic Med. coast, Egypt. Project No. 90009, FRCU, Supreme Council 9fEgyptian Universities: 23 - 57.

Osman F., Fayad, Seham & Zahran M.A. (1976). Potentialities of the seeds of the Egyptian flora for oil production. Bull. Fac. Sci. Mansoura Univ. 85 - 95.

Shaaban-Dessouki, S.A. (1994). Role of blue green algae and superphosphate enrichment in reclamation of the salt affected lands of the deltaic Med. coast, Egypt. J Env. Sd. Monsouta Univ., 7: 282 - 298.

Taha, A., Abdel Dajem, A..M. & El-Sankary, M. M. (1991). The hydroglogical setting of the deltaic coast of Egypt. In: Report entitled Revegetation of the salt affected lands of the deltaic Med. coast Egypt. Project No.90009. FRCU, Suprenie Council ofEgyptian Universilies: 140 - 216.

Zahran. M.A. (1993). Jzincus and Kochia: Fiber and Fodder Producing halophytes under salinity and aridity stresses. In: (Pessarakli, M., ed.): 505-530. Handbookofplant and CropStress, Marcel Dekker, Inc. N.Y.

Zahran, M.A. & El-Habibi, A.M. (1979). A phytochemical investigation on Juncus seedsBull. Fac. Sc. Mansoura Univ. 5 : 1 - 14.

Zahran, M.A., Abdel Wahid. A.A. & El-Demerdash, M.A (1978). Economic potentialities of .juncus plants. Proc. Arid fond Plant Resources hit em. Gonf Texas Tech Univ., fuhhock, Texas. USA: 244 - 260.

Zahran. MA., El-Demerdash, MA. & Mashaly,I.A (1985). On the ecology of the deltaic coast of the Mediterranean Sea Egypt Proc.Egypt. Bot. Soc. 4:1392- 1407.

Zahran, M.A & Witlis, A.J. (1992). The Vegetation of Egypt. Chapman & Hall. London: pp.424.

Zahran, M.A., Muhammed, Bahira, K. & El-Dingawi A.A. (1992). Establishment of Kochia forage halophytes in the salt affected lands of the Arab countries. J Env. Sci. MansouraUniv.4 : 93 - 113.

Zahran. M.A., Muhammed, Bahira, K., Hassan. T. E. & Abdel Fattah, 6. M. (1993). *Juncus subulatus* and *Dijiachne usca*: Potential forage halophytes in Egypt. Bull. Fac. Sci. Afansowa University: 20 (1): 195 - 215.

Zahran, M.A., Mohammed, Bahira, K. & Mashaly, I.A. (2000). Introduction of non-conventional livestock fodder under drought and salinity stress of arid lands. Proc. Livestock/Drought Policies f)J Coping with Changes. FAO/DRC, Cairo, April 1999 (in press).

Fig. 2. Sketch diagram of the zonation pattern of the habitat types of 4 sea, landward belt transects each 5 km width and 10 km length representing the plant life of the four study sites of the Deltaic Mediterranean coastal belt of Egypt.

A- Kafr El-Bateikh (Damietta)

Mediterranean Sea
1
Za 2
Am 3 Hs
4
Hs 5 Am
Sv 6
Pa 7
Pd 8
Ft 9
Cultivated lands

B- Qalabshu (El-Dakahlia)

Mediterranean Sea
1
Za 2
Am 3
4
Ef 5 Za
Am 6 Za
Ef 7 Cc
Sl 8 As
Am 9 Hs / Ja Jr
Es 10 Mc
Cultivated lands

C- Baltim (Kafr El-Sheikh)

Mediterranean Sea
1
Ss 2
Ss 3 Cyc
Ja Jr / 4 / Hs Am
Pm 5 Es
Cd 6
Ft 7
Td 8
Cultivated lands

D- Rosetta (El-Beheira)

Mediterranean Sea
1
Za 2
Ef 3
4
Spv 5
Lc 6
Am 7 La
Es 8
Ca 9
Td 10
Cultivated lands

a- Legend numbers of the habitat types of the Deltaic coastal belt :

A:
1- Bare sandy beach
2- Low Sand mounds
3- Raised sand mounds
4- Barren salt marshes
5- Salt marshes
6- Sand flats
7- Reed swamps
8- Fertile non-cultivated lands
9- Orchards

B:
1- Bare sandy beach
2- Low Sand mounds
3- Raised sand mounds
4- Barren salt marshes
5- Extensive sand flats
6- Irregular sand flats
7- Mobile sand dunes
8- Partial stabilized dunes
9- Salt marshes
10- Stabilized sand dunes

C:
1- Bare sandy beach
2- Sand flats
3- Mobile sand dunes
4- Salt marshes
5- Stabilized sand dunes
6- Fertile non-cultivated lands
7- Orchards
8- Reed swamps

D:
1- Bare sandy beach
2- Low sand mounds
3- Medium sand mounds
4- Barren salt marshes
5- Sand flats
6- Mobile sand dunes
7- Salt marshes
8- Partial stabilized dunes
9- Fertile non-cultivated lands
10- Reed swamps

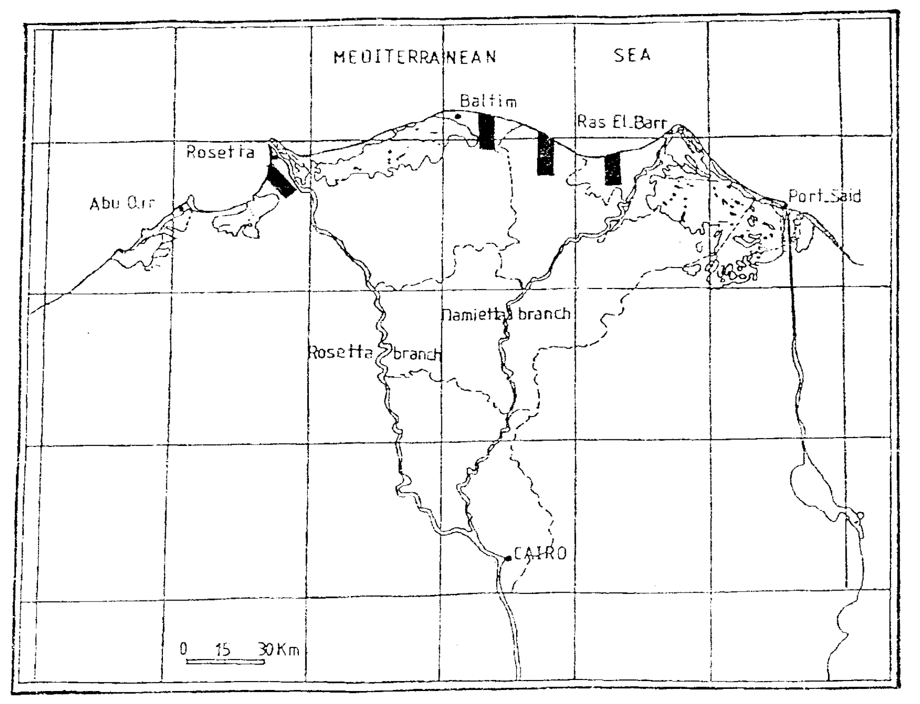


Fig. 1. Map of the Nile Delta of Egypt showing the deltaic Mediterranean coast and the four studied sites are shown in black column.

Table (1): Chemical Analysis of Six fodder halophytes naturally growing in the deltaic Med. Coastal desert, Egypt (by Dr. Bahira Kamel Mahmoud, Inst. of Animal Production, Agric. Res. Center, Cairo).

	Fodders					
Parameters	*Acacia sahgna*	*Atriplex halimus*	*Atriplex nummularia*	*Atriplex searibaccata*	*Paspalum distichum*	*Scirpus litoralis*
Dry Matter(%)	38.12	29.32	27.35	36.58	53.95	20.43
Crude Protein(%)	15.35	9.35	18.24	13.15	6.18	17.82
Nitrogen Free extract(%)	58.85	35.94	35.66	49.13	47.75	14.79
Ether Extract(%)	2.52	1.19	3.72	2.15	1.05	1.62
Crude Fiber(%)	12.79	28.45	17.58	18.22	30.87	25.16
Ash (%)	10.49	25.14	24.8	16.85	14.15	13.60

compared to the plants grown in the non-inoculated saline soil. It seems that this fungus succeeded to overcome the deterinintal growth effect of soil salinity and, thus improved soil productivity. Other microorganisms, namely algae, bacteria and actinomycetes, have been also successfully tested (Shaaban- Dessouki, 1994 and Mansoure 1992).

b- Other Fodder Species

The chemical analysis of the other 6 fodder species shown in Table I elucidate that all of these plants, which are palatable in their natural stands by livestock, contain variable amounts of nutritive matter. The crude protein varied between 18.24 % in the chenoped *Alilpiex nirninirulaija* and 6.18 % in the grass *Paspalurn distichurn*, on the other hand the leaves of the legumenous shrub *Acacia saligna* contain the highest (58.85%) amount of nitrogen free extract followed by *Atriplex sernihaccata* (49.13%) *Paspaluni dislichuni* (47.75%), the sedge *Scitpus litoralis* (41.79%), then, *Atripiex halirnus* and *A. nunirnularia* (35.97% and 35.66%) respectively. The crude fiber contents varied between 30.87% in the grass *P. dislichuni*, 28.45% *inil. halinius*, 25.16% in the sedge *S. litoralis* with the lowest amount (12.79%) recorded in the tissues of *A. saligna* leaves. The relatively highest amount of ether extract (3.72%) was determined in the branches of *Aitiplex nummularia* followed by *A. sernihaccala* (2.65%) and *A. saligna* (2.52%) the lowest amount (1.05%) was that of *P. disuchuni*, which contains the highest amount (53.95%) of the dry matter. Wide variation was found in the ash contents of these six species as it ranges between 25.14% in *A. halinius* and 10.49% in *A. saligna*.

CONCLUSIONS

Based on the aforementiond reuslts, the following conclusions may be obtained:

1- The halophytes and xerophytes naturally growing in the Egyptian deserts are the most promising option to overcome the shortage of raw materiais in various industries e.g. livestock fodder, printing paper etc.

2- The non-productive salt affected lands can be changed to productive ones through the propagation of certain halophytes e.g. *J. rgidus, J. acutus, K. indica* etc. of agro-industrial potentialities.

3- Thus, it is time to state that. the renewable natural resources including plants, soil, ground water, solar energy etc. present permanent promising solution through which the sustainable environmental development of the coastal and inland deserts of Egypt well be achieved.

clover hay which became expensive and not easily available in Egypt due to the limited area cultivated by the traditional green forages (clover and alfalfa). It seems that rabbits did not easily accept the materials of both *Juacus* and *Lcpiochloa* They refused them in the beginning, but they gradually accepted them. The daily intake in the first day was 20.0 and 25.0 gm and then increased to 60.0 and 55.0 gm at the 10th day for rabbits fed *Juncus* and *Leptochloa* averaged 40.3% and 39.6% in comparison with the dry matter intake of those rabbits fed on the commercial ration. The corresponding figures after 15 days were 45.2% and 43.7% for the *Juncus* and *Leplochloa* respectively. These results show that the digestibility coefficients of the commercial ration were higher than those of both *Junncus* and *Diplachne*. The satisfactory digestibility of *Juncus* and *Lepiochloa* in comparison to the commercial ration and their lower palatability which caused the deterioration of live body weight may suggest that it is possible to include *Juncus subulatus* and *Leplochloa fusca* hays in rabbit feed mixture instead of clover hay up to 40% (Zahran *et al.*, 2000). Propagation experiment on *K. indica* was conducted in a saline land in Om El-Reda Village located at about 40 km south of the Mediterraneen Sea and about 20 km west of Damietta city. The conventional crops, usually cultivated in the other productive lands of the Nil Delta, would fail to grow in this land due to its high salinity. Propagation of *K. indica* was by seeds collected from its natural stands in the Nile Delta. Experiment continued for 7 month starting January 1988. Shoot harvesting was carried out 3 times: 3,5 and 7 months after cultivation. The results are encouraging. The vegetative yields of *K. indica* fodder halophytes increased by aging being: 0.5 ton/Feddan, 2.2 tons/Fedden and 4.5 tons/Feddan on dry weight basis, respectively.

Grazing potentialitics of *K. indica* was observed in the site of the experiment. Ruminant (cattle and sheep) and non-ruminant (donkeys) animals left to graze freely for about one month. All animals ate the plant without any symptoms of toxicity (Zahran *et al.*, 1992).

Biological Soil Desalination

Many attentions has been paied to the reclamation of the saline soils particularly in arid land countries. However, addition of soil amendments and fertilizers and the retention of salts further complicate the problem. Soil biological desalination seems to be the more safe way. In the present study, improvement of the salt affected land of the deltaic Mediterranean coast, had been tested using *Juncus* (fiber) plants and microorganisms.

The success of *Juncus* cultivation in the saline soil was associated with another advantage that increases its economic values. Being cumulative halophytes, *J. rigidus* and *J. acutus* accumulate excess salts they absorbe from Soil in the tipper parts of their culms (Zahran, 1993). "Each harvest is diminishing the salt content of the soil and/or ground water".(Boyko, 1966).

Zahran *et al.* (1993) found that the growth, and cousequenthy the vegetative yields of *Juncus subulatus* fodder halophyte was higher in the saline soil inoculated with AV mycoribizal fungus *(Glomus mosseae)* when

ash (9.42%), contents of crude fiber (48.6%) and organic matter (90.58%) were higher than those of the offered and consumed portions. The crude protein (19.82%) and ash content (21.27%) of the consumed *Kochia* fodder are higher than those of *Alfalfa* hay (13.9% and 8.3%, respectively) whereas the other measurements are generally lower in *Kochia*. The considerable high ash content (21.27%) of the consumed portion of *Kochia* may be attributed to its relatively low content of organic matter (78.73%) than that of *Alfalfa* hay (91.7%).

Voluntary dry matter intake, average digestion coefficient, feeding values and nitrogen balance of the consumed portions of *Kochia* by the 3 rams were estimated. Generally, dry matter consumption decreased as plant maturity progressed. Feed refusals of *Kochia* are composed primarily of coarser materials of the large central stems. Total digestible nitrogen of *Kochia* is relatively low (46.9%), this is probably a function of the high ash contents which apparently has relatively high digestibility as indicated by the slightly high digestion coefficient of the dry matter (60.58%) than that of the organic matter (60.22%). The TDN of alfalfa is 50.3%. The other feeding values of *Kochia* are expressed as starch values (25.85%) and digestible crude protein (14.12%).

The results of nitrogen balance test reveal that the daily nitrogen intake of *Kochia* shoots is 42.4 gm/day, nitrogen retention is 1.55 gm/day (in alfalfa these items are 20.0 gm/day and 4.1 8 gm/day, respectively). The low nitrogen retention in *Kochia* is largely a function of less efficient utilization of absorbed nitrogen which in turn is an influence of the high urinary nitrogen excretion (14.69 gm/day).

The chemical analyses of the materials of *Juncus subulatus* and *Leptochloa fusca* (Zahran el al. 1993) show that, the two halophytes contain comparable amounts of dry matter, organic matter, ether extract, nitrogen-free extract, crude protein and ash, being: 30 and 35%, 89.6 and 88.47%, 1.7 and 2.2%, 47.2 and 49.4%, 16.1 and 8.7% and 10.4 and 11.6%, respectively. Mowever, *J. subzdalus* contain much higher amounts of crude protein (16.1%) than *L. fusca* (8.62%) and clover hay (11.7%). The crude fiber of *J. suhulatus* is comparatively lower (24.6%) than those of *L. fusca* and clover hay, being 28.24% and 28.12%, respectively. The TDN and DCP of these two plants are: 57.21% and 10.72% and 53.73% and 5.64%, respectively.

The feeding of 36 unisexed 6 weeks aged New Zealand white rabbits on the two plants (*J. subulatus* and *A. fusca*) for 12 weeks as a whole feed without any supplementations except vitamins and mineral mixtures caused a considerable deterioration of body status especially with *L. fusca*. After 10 days preliminary period, the reduction in live weight in comparison to the initial live weight was 10% and 28.6% with *Juncus* and *Leplochloa*, respectively. The corresponding figures after 15 days were 12.5 and 33.3%, respectively. Rabbits that were fed the commercial ration (control) increased their liver weight by about 12% and 1 8.3% after 10 and 15 days, respectively. This result indicates that using the two plants as the only feed is not practical but their materials may be used in the commercial rations up to 40% instead of

Field establishment experiment was conducted in the poorly drained salt affected land associated with Lake Manzale. The results of this experiment (Zahran, 1993) show that both *Juncus spp.* may be cultivated on such bad non-productive soil. After one year of growth it was found that the mean heights of *J rigidus* and *J. acutus* culms were 162 cm and 85 cm, mean fresh weight were 4.96 kg/plot-1 and 2.81 kg/plot-1 and the mean dry weights were 1 .95 g/plot-1 and 1.11 kg/plot-1, respectively.

B- Fodder Plants

The nutritive values of eleven halophytes of the deltaic Mediterranean coastal desert as well as the digestibility of three of them (*K. indica, J subulatus* and *L. flisca*) are briefly described in the following:

a- *K. indica, J. subulatus* and *L. fusca.*

The chemical analysis of *K. indica* parts collected from its natural stands of the Mediterranean coast of Egypt (Zahran, 1993) showed that:

The green branches and hay contain: 84.19% and 7.68% water, 0.36% and 1.56% fat 3.41% and 18.63% crude protein, 5.21% and 24.17% N-free extract, 4.11% and 35.91% crude fiber and 2.72% and 20.11% ashes respectively. The shoot and root systems contain: 0.706% and 0.373% soluble sugars, 4.738% and 6.295% total carbohydrates and 294 mg% and 85 mg% alkaloids, respectively.

The digestibility trial with nitrogen balance was carried out to evaluate the feeding values of *Kochia* green branches. The trial was made on 3 rams free from intestinal parasites (Zahran etal., 1992). Rams were weighed at the beginning and at the end of the experiment to ensure that they were maintaining their weights. The trial was preceded by one month adaptation period to allow maximal feed intake followed by 14 days preliminary test. The collection period (the actual trial) extended for one week. In all cases, the air-dry green *Kochia* shoots were chopped to one inch pieces to be used as feedstuff without mixing it with any other material.

Kochia was offered to satisfy maintenance requirements (25 g starch equivalent/0.75 kg body weight). The daily allowance for each animal was given in two portions: at 8 a.m. and at 3 p.m (3 kg air dry *Kochia*/ram/day). Intake of *Kochia* was measured once daily. Water was available all times. Total faeces and urine collections were made every 24 hours.

Representative *Kochia* samples and composite faecal samples were taken during the collection period for proximate analysis. A 10% lot of the daily urine extraction was taken in a composite sample for analysis according to the method of the Association of the Official Analytical Chemists (AOAC) 1956. For the determination of nitrogen content in urine 5 ml sample was used.

The analysis of the chemical compositions of *K. indica* forage (offered, refused and consumed) as being compared with those of alfalfa hay show that the refused portion, formed mainly of the central, large and relatively, stiff branches, contains low amounts of crude protein (7.71%) and

species from the neighbouring cultivated lands. Generally, the fertile non-cultivated lands occur between the agricultural land and the coastal area.

This habitat is dominated by *Pluchea dioscoridis, Cynodon dactylon* and *Convolvulus arvensis*. The common associated species are: *Lotus corniculatus, Phyla nodiiflora, Polypogon viridis, Cynanchum aculum, Aniaranthus graceizans, A. ascendens* and *Aster squanialus*.

ROLE OF NATURAL PLANTS IN DESERT DEVELOPMENT

The floristic elements of the vegetation types of the deltaic Mediterranean coastal desert, being the producers of this ecosystem, have certain economic potentialities particularly as fodder for livestock. Local inhabitants used to leave their animals to graze the palatable species. In addition some plants are used as traditional drugs and others are used to manufacture some simple fiber products e.g. mats etc To evaluate the economic potentialities of the natural halophytes of this coastal desert, eleven species of its natural vegetation had been analyzed chemically These species are: *Juncus acuus and J. rigidus (*fiber plants) and *Acacia saligna, Atriplex hamius, A. nummularia, A. seniibaccata, Juncus subidatus, Kochia indica, Leptochlea fusca, Paspaizim distichurn and Scirpus litoralis* (fodder plants). Production of printing paper from the culms of *J. acutus* and *J. rigidus* had been tested in the laboratory of the National Paper Company in Alexandria. Rams and rabbits were fed with *K. indica, J subulatus* and *L. fusca* materials. The growth and establishment of *J. acuizis, J. rigidus and K. indica* were experimented in the salt affected lands of this coastal desert.

A- Fiber plants

J. rigidus and *J. acutus* are highly salt tolerant rushes widely occur in the inland and coastal salt marshes of Egypt. Both are cumulative halophytes (Zahran, 1993).

J. rigidus and *J. acutus* have many importaut uses both in old and recent times. They were used in earlier days in making mats, sandals and writing pens. (Tackholm & Drar 1954). Recenlty, it was found by Osman *etal.* (1975), that the seeds of these rushes are rich in fatty acids. Zahran & El Habibi (1979) found 13 amino acids in these seeds. However, the most important industrial use of *J. rigidus* and *J. acutus* is as culms (the green leafy - shoots) which are used as raw material in paper industry.

The fiber length reasurement indicate that the mean values of *J. rigidus* and *J. ocutus* culm range between 849.1 - 1451.7 and 791.0 - 15926 micra respectively. The chemical analyses and pilot plant experiments proved that the culms of *Juncus* contain low ash (6.5%), low lignin (13.3%), high a-cellulose (39.8%) and high yield of tiableached pulp (36.8%). The strength properies of the depithed Juncus pulp are much higher than those of rice straw and bagasse. The grade index of *Juncus* pulp 73% as compared to that of the imported softwood long fiber pulp (100%) and to those of rice straw (24%) and bagasse (42%), Zahran *et al.* (1978).

dunes are dominated by *Echinops spinosisssimus, Moltkiopsis ciliata* and *Pancratium naritimum* at Qalabshu and Baltim sites.

d- Cultivated dunes at Qalabshu, Baltim and Rosetta are characterized by shrubs of figs. grapes and palm trees together with some vegetable cultivations such as tomatos and water melons. The common species in these dunes are: *Lycium schweinfurthii, Thynielaca hirsuta, Stipagrostis scoparia, Alhagi graecorum, Launaea resedifolia* (perennials), *Senecia glaucus, Cakile niarilinia, Plantago squarrosa, Lotus halophilus, Rurnex pictus, Ononis serrata and Cutandia memphitica* (annuals).

6- Vegetated Salt marshes

The salt marsh habitats are characterized by high level of salinity. They may occupy the depressed areas between the sand dunes. They are usually wetted by sea water due to fluctuations of water table level. Two types of salt marshes are distinguished in the study area:

a- Dry salt marshes which occupy the saline habitats with relatively deep water table. These are dominated by *Arihoenernuni marcrostachyuni, Haloenernum sirobilaceum and Linioniurn angustifolium.* The common associated species are: *Zygophyllum aegyptium, Jnula crifhmoides, Sporobolus virgin icus, Sporobolus spicalus, Frankenia hirsuta, Limonium pruinosum* and *Cressa crelica.*

b- Wet salt marshes are the saline habitats with relatively shallow water table and usually wet. This habitat is frequent in Qalabshu and Baltim sites and it is dominated by *Juncus rigidits* and *Juncus acutus.* The common associated species are: *Bolboschoenus marilinius, Cyperus laevigatus, Juncus subillatus, Halimione portulaco ides, Ph ragnules australis* and *Tamarix teiragyna.*

7- Reed Swamps

The swampy habitats are frequent in the study area. They occupy most of the landward area of the transects at the border of the fertile non-cultivated and agricultural lands. They are formed by the accumulation of water seeped from northern lakes, Mediterranean sea and/or drainage system of the delta in depressed areas. The soil of this zone is covered with water all the year round and is dominated by reed swamp vegetation. In areas with high salinity level, *Phragmites australis* is the dominant. While in less saline areas, *Typha domingensis* predominates. The associate species include water-loving species such as: *Cyperus articulatus, Cyperus laevigalus, Scupus litoralis, Polygonum salicifoliurn, Pluchea dioscoridis* and *Paspalidiuni geminatum.* Some halophytic species grow on the saline fringes of the swamps such as: *Juncus rigidus, J. acutus, J. sub ulatas, Inula crithrnoides, Tainarix fetragyna, Carex extensa and Halimione portulacoides.*

8- Fertile non-cultivated lands

This habitat had been previously reclaimed for cultivation, but due to declined land quality, continuous neglection, increased salinity and shallow water table, the land is degradated and desertified. This habitat type is mainly cultivated with vegetables such as water melon and tomato as well as fruit trees (orchards) such as date palm, guava and citrus. Specific plant life has been evolved including growth of weed flora and invasion of many plant

marshes, that are dry most of the year. This zone is not represented in Baltim site but it is well represented in the other three study sites.

In some areas, this semi-barren landscape contains a distinct microhabitat in a form of scattered small hummocks that are elevated above the barren surface. These microhabitats support the growth of *Arthocnenmum macrostachyum, Halocnemum strobilaceum* and *Zygophyllum aegyptium*. Due to strong winds and water washing of the surface, some of these habitats are subject to erosion causing plant growth to be restricted in relic areas.

4- Sand Flats

These areas are more or less flat (sand sheet) with slight undulations. They are found in the four study sites. In Kafr El-Bateikh site, the sand flat extends for a bout 500 m length and are located at about 2 km from the seashore. It lies between the salt marshes and reed swamps in the area. This habitat type is dominated by *Suaeda vera* associated with *Arthrocnenium macrostachyum, Halocnemum, Strobilaceum, Zygophllum aegyptiuni* and *Slipagrostis lancria*. In Qalabshu site, the sand flats can be divided into two types:

a- Extensive sand flats of about 600 m width south of the barren salt marsh zone. In this subhabitat, two communities are distinguished: *Elynmus farcius* community in the northern part and *Zygophyllum egyptium* community in the southern part of this site.

b- Irregular sand flats represented by undulated belt of about 500 m width south of the extensive sand flat belt. Two communities occurs in these flats dominated by: *Arthrocnemum macrostachyum* and *Zygphyllum aegyptium*.

The sand flats in Baltim site form a narrow belt of about 200 m width next to the bare sandy beach zone dominated by Silene succulenta. In Rosetta site, the sand flats are slightly raised with width of about 800 m occupying a belt next to the barren salt marsh zone. This habitat is dominated by Sporobolus virginicus. In the sand flats, the common associated perennial species are: *Calligonuni coniosurn, Alhagi graecorurn, Launaea resedifolia and Cynodon dactylon while,* the associated annual species are: *Cakile maritima, senecio glaucus and Salsola kali.*

5- Sand dunes

Four kinds of sand dunes are recognized in the study area: mobile dunes, partially stabilized dunes, old stabilized dunes and cultivated dunes.

a- Mobile dunes are usually of varying sizes and are generally characterized by the growth of *Elymus firctis*, *Calligonuni comosuni* (at Qalabshu), *Silene succulenta*, *Cuperus capitatus* (at Baltim) and *Lotus creticus* (at Rosetta).

b- Partially stabilized dunes are denser than mobile dunes in vegetation. These dunes are dominated by *Stipagrostis lajiata*, *Asparagus stinularis* (at Qalabshu) and *Echinops spinosissinius* (at Rosetta).

c- Old stabilized dunes are vegetationally the most richest dunes because they become protected from the direct effects of maritime influences. These

The soil of the deltaic Mediterranean coastal desert is mainly sandy on marine deposits. They are, in general, salt affected with various degrees of salinity. EC value varies widely between 1.66 mmohs/cm and 80.04 mmohs/cm with pH between 7.0 - 7.8. The organic carbon and calcium carbonate contents are generally low with values between 0.15 % - 1.3 % and 0.7 % - 18.1%, respectively. As regard soil classifications the soil of this coastal belt belongs to the solonchak type according to the FAO and to the Fntesol type according to the American systems. (Meshrif, 1990).

Natural Vegetation

The vegetation of the deltaic Mediterranean coastal desert had been studied in 4 representative sea-landward belt transects in 4 sites located in: Kafr EL-Bateikh, Kalabshu, Baltim and Rosetta. The length of each transect (N-S direction) was 10 km with a width (E-W direction) of 5 km (Figs.1 and2).

The results of the vegetation analysis of these transects show that the study coastal belt may be categorized ecologically into 8 habitats, namely: bare-sandy beach, and mounds, barren salt marshes, sand flats, and dunes, vegetated salt marshes, reed swamps and fertile non-cultivated lands. (Zahran el al., 1985).

1- Bare sandy beach zone

This zone extends for about 200 m southward along the coast in the four study sites. This zone is subject to the rise and fall of tide that produces anaerobic soils which support no vegetation. The changes in tidal inundation time with elevation above mean sea-level and evaporation from the surface result in salt accumulation. Tidal movements and sea currents constantly disturb any possibility for vascular plant establishment.

2- Sand mounds

This habitat type usually occupies the shore-line zone extending for about 250 m width. It is present in three sites: Kafr El-Bateikh, Qalabshu and Rosetta but it is absent in Baltim. This habitat can be subdivided into two types:

a) Low sand mounds

The mounds are dominated by *Zygophyllum aegyptium* in the three study sites.

b) Raised sand mounds

These mounds are codominated by *Arthrocnemuni macrostachyum* and *Halocnemum strobilaceum* in Kafr El-Bateikh site, dominated by *Arthrocnenium macrostachyum* in Qalabshu site and dominated by *Elymus farctus* in Rosetta site.

Few individuals of annual species have been recorded in the sand mounds such as *Cakile maritima*, *Senecio glauca* and *Salsola kali*.

3- Barren salt marshes

The barren slat marshes cover a width of about 12.5 km. This habitat supports a relatively low plant diversity and constitutes a slippery black-salt

feeders of these costal dunes, most of which are low and narrow with width ranges from 0.5 to 1.5 km. Some dunes with small depressions in between make temporary lakes (like in Baltim). These dunes represent collecting areas for the rainfall water and obstacle for the run-off water. Fresh water seepage from these dunes is used for irrigation purposes. However, the vertical infiltration of water has replenished the underneath subsoil aquifer, especially in winter. So it is easy to obtain fresh water from the hollows beside and between the dunes which explains the flourishing of palms, and some other cultivations near Kafr El-Bateikh, Aian and Baltim areas. These dunes may be classified into backeshore dunes (up to 25 m high) and foreshore dunes which separate the north margin of the lakes and depressions from the sea.

The surface water system comprises the River Nile branches, the irrigation- drainage network and the open ditches that covers the northern newly reclaimed lands. The irrigation network generally start from the south and extends radial northwards, while the alternating drainage network debauch their water in the natural lakes and the Mediterranean Sea. Generally, the irrigation channels follow high topographic stretches, while the drainage canals follow low land. The subsoil water is very close to ground surface (less than 1 m depth at many locations) and is occasionally intermingled with the surface water from drains, canals and/or lakes. Although the depth to subsoil water varies from 80 cm to more than 2 m, yet, several anomalies noted were attributed to local conditions. The closeness of the subsoil water to the ground surface is harmful to the crop yield in the cultivated areas and may deteriorate the soil. The variation in depth of water of the subsoil zone is possibly attributed to the surface relief, the miss-use of irrigation water arid the inadequate drainage system or the soil texture. Moreover, the potentiometric surface of the groundwater in this zone is governed by the hydrostatic pressure, due to the presence or absence of the impervious clays at the bottom of the subsoil section. Certainly, the relation of the subsoil water with the deep groundwater is very important for future study. Such type of study needs not only shallow to moderate drilling, but also deep boring to penetrate the different subsurface zones in several localities. Chemical analysis of representative samples show that the water in general is salty to brine with a wide range of salinity that may be summarized in the following:

1- Dealing with surface water; the salinity of the drains water ranges from 1.6 gm/L to more than 30 gm/L, meanwhile the canal water is relatively deteriorated at the northern part of the study area. A sample collected from Bahr Tira Canal north El-Khashaa showed a salinity of 1.24 gm/L. This means that there is a partial mixing from the groundwater seepage and/or drain water to the canals at their northern extremities.

2- The subsoil water has salinity ranging from 3.6 gm/L to more than 250 gm/L. The low salinity value is restricted in the vicinity of the sand dunes.

3- The groundwater has salinity ranging from 4.3 gm/L to about 90 gm/L in the coastal strip of the study area. The low salinity value has been recorded at El Wastani and Sidi Youssef wells.

THE STUDY OF COASTAL DESERT

The Physical Environment

The following is a short account on the climate, geomorphology, water and soil types and characteristics of the study coastal desert.

The deltaic Mediterranean coastal belt is the middle section of the Mediterranean coast of Egypt. The western sec tion of the Mediterranean coast extends between Sallum eastward to Abu Qir for about 970 km whereas the eastern section extends for about 240 km between Port Said and Rafah. The deltaic Med. Coast extends for about 180 km from Abu-Qir eastward to Port Said with an averrage width in a N-S dirncttion for about 15 km from the sea (Zahran *et al.*, 1985), Fig. 1.

The climate of this coastal belt is arid: hot and dry. The main maximum and minimum temperatures vary between 17.9 - 31.31°C and 8.2 - 21.5°C in summer and winter, respectively. Relative humidity varies between 69 - 84 % and evaporation rate ranges between 2.8 - 5.4 mm/day Piche. More than 80% of rain occurs during Nov.-Feb. period, summer is dry. Total annual rainfall varies between 102.3 - 160.0 mm. Winds are generally light but violent dust storms and sand pillars are not rare. El-Khamsin winds blow occasionally for about 50 days during spring-summer. N, NW and SW winds together witth El-Khamasin are responsible for the formation of sand dunes and other land forms of the area. (Zahran & Wills 1992, Zahran el al., 1985).

Geomorphologically the deltaic coastal desert may be classified into 4 units: the extensive backshore flats, the flooded low lands, the peripheral lakes and the coastal dunes (Taha & Abdel Daiem, 1990). The backshore flats occupy most of the study coastal desert, not more than 2 m a.s.l., sometimes covered by flat expanses of beach sand. The western part: Rosetta, Sidi Yousef and Burollos plains are flooded during winter storm surges. Salinity problem is quite obvious at several places where mineral salts are concentrated at the soil surface through evaporation. The flooded basin are formed by the occasional rising saline water level is the lakes and/or the evaporation of surface water and subsoil water by capillary actions. Many areas south the shoreline are inundated by water more or less permanently giving way inland to areas obviously flooded each year. Sabkhas, salinas and marshes are developed in the vicinity of the permanently wet areas in various stages of desiccation. The deltaic coast is characterized by 3 shallow lakes occupying wide areas of the northern part of the delta, these are: Lake Manzala (east), Lake Burollos (middle) and Lake Idku (west). These lakes receive the main bulk of the drainage Water collected from the Nile Delta. They are separated from the sea by strips of land that are very narrow in several places and are connected with the sea through outlets. Many areas around these lakes are more or less permanently covered by water as a result of flooding from the lakes and inland canals. Some areas develop salt flats while others develop marshes.

The dominate N and NW winds transported very large amounts of sand to the beaches and further landward. These backshore plains are the main

NATURAL VEGETATION AND ENVIRONMENTAL DEVELOPMENT IN THE EGYPTIAN DESERTS: AN ECOLOGICAL APPROACH

M.A. Zahran
Department of Botany, Faculty of Science, Mansoura University, Mansoura, Egypt
E-mail: Sinfac@mum.mans.eun.eg, Fax: 050- 346781

ABSTRACT

The vegetation types of the coastal and inland deserts of Egypt are characterized by drought and/or salt tolerant species. Ecological studies revealed that many of these floristic elements can play an important role in the desert development. The present review-paper throws light on the results of scientific projects initiated more than 25 years ago aiming at the introduction of some species of the desert vegetation of Egypt as raw materials for the production of printing paper and livestock fodder. The selected species are: *Juncus acutus* and *J. rigidus* (fiber plants) and *Acacia saligna, Atriplex halimus, A.mummularia, Juncus subulatus, Kochia indica, Leplochioa fusca, Paspaluni distichum* and *Scirpus litoralis* (fodder plants).

Field experiments conducted in the deltaic Mediterranean coastal desert of Egypt, laboratory analysis, feeding tests etc. revealed that: 1) *Juncus acutris, J. rigidus* and *Kochia indica* could be cultivated as non-conventional crops in the salt affected lands, 2) the vegetative yields of both *Juncus* species produced good quality printing paper, 3) the studied fodder plants are rich in their nutritive materials and 4) animals fed on *K indica* (rams) and *Juncus subutus* and *Leplochloa fusca* (rabbits) gained weight without side effects. Thus, achievement of the agro-industrial development of the Egyptian deserts may depend in future on their natural wealth of xerophytes and halophytes.

INTRODUCTION

Egypt, being part of the arid region of the world, is facing five major problems, namely: high rate of population increase, limited natural resources, ill advised land use, shortage of food for humans and forage for livestock and shortage of raw materials for various strategic industries e.g. printing paper etc. Therefore, efforts have been directed towards the utilization of the renewable natural resources particularly vegetation, groundwater and soil of the Egyptian coastal and inland deserts for the welfare of the Egyptian people.

Multi-purposes projects have been initiated by the author 25 years ago (funded by international and local doners e.g IFS of sweden, FRCU of the Supreme Council of Egyptian Universities and Mansura University) have been implemented in the salt affected deltaic Mediterranean coastal desert. The present paper briefly review results obtained from these piojects aiming at the agroindustrial utilization of some selected plants naturally growing in this part of the Egyptian coastal desert.

Tabe of content

Cairo University
Inst. of African Research and Studies.
Dept. of Natural Resources



NATURAL RESOURCES AND THEIR CONSERVATION IN EGYPT AND AFRICA.

A Symposium held between 19 and 21 March 2001

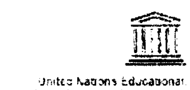
Celebrating the 30th anniversary of the Department of Natural Resources & 80th birthday of

Prof. Dr. Mohamed Abd El-Fatah El-Kasas
The International pioneer of Botany and Environmental science.

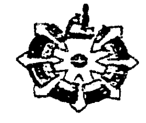
Under auspices of

Prof. Dr. Nageeb El-Hilali Gohar.
Cairo University president.

Sponsored by



مكتب اليونسكو بالقاهرة



أكاديمية البحث العلمي
Academy of Scientific Research & Technology



جهاز شئون البيئة
Egyptian Environment Affairs Agency



وزارة الزراعة
Ministry of Agriculture

Dean of Inst.	Head of the department
Prof. Dr. El-Sayed Ali Ahmed Filefil	**Prof. Dr. Fawzia Ibrahim Morsy**

Symposium coordinator
Prof. Dr. Samir Ibrahim Ghabour

تم بحمد الله تعالى طباعة الكتاب الخاص
بهذه الندوة بقسم التصوير
بمعهد البحوث والدراسات الأفريقية – جامعة القاهرة

تحت إشـــراف

السيد/ إبراهيم أبو العينين (أمين المعهد)
السيد/ حسنين عبد العال (رئيس قسم التصوير)
السيد/ محمد صلاح الدين غازى (فنى التصوير)
السيد/ أحمد عبد المقصود أحمد (فنى التصوير)

رقم الإيداع: ٢٠٠٤/١٠٨٦٧